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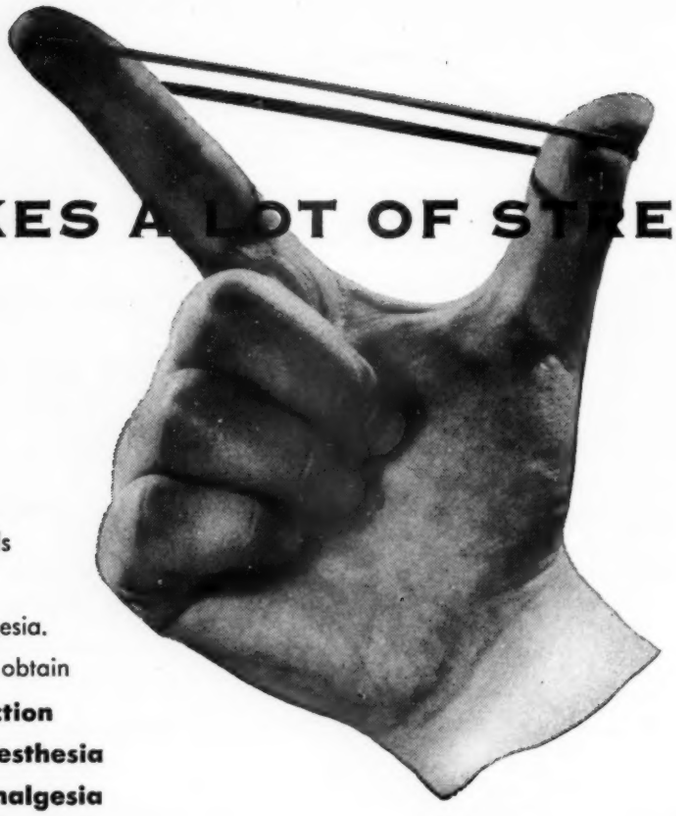

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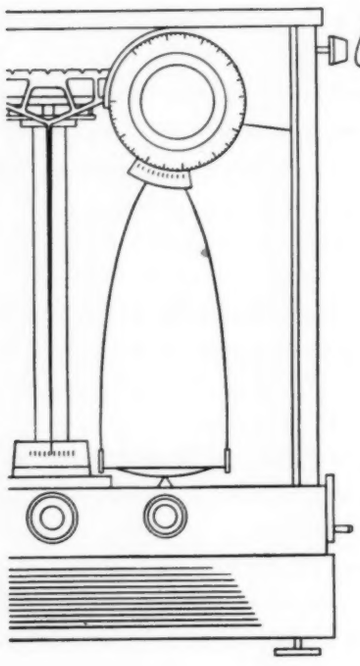

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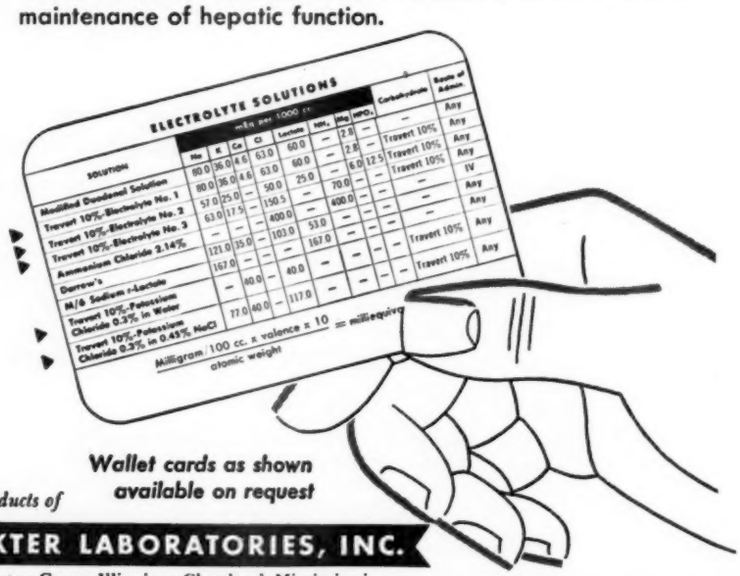

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2. Upton, J. R.: Symposium: Certain Aspects of Office Treatment in Obstetrics and Gynecology: Trichomonas Vaginalis Vaginitis, West. J. Surg. *60*:222 (May) 1952.

3. Kleegman, S. J.: Treatment of Trichomonas Vaginitis, GP *6*:49 (Aug.) 1952.

4. Kanter, A. E.: The Recognition and Treatment of Vaginal Lesions, Postgrad. Med. *12*:457 (Nov.) 1952.

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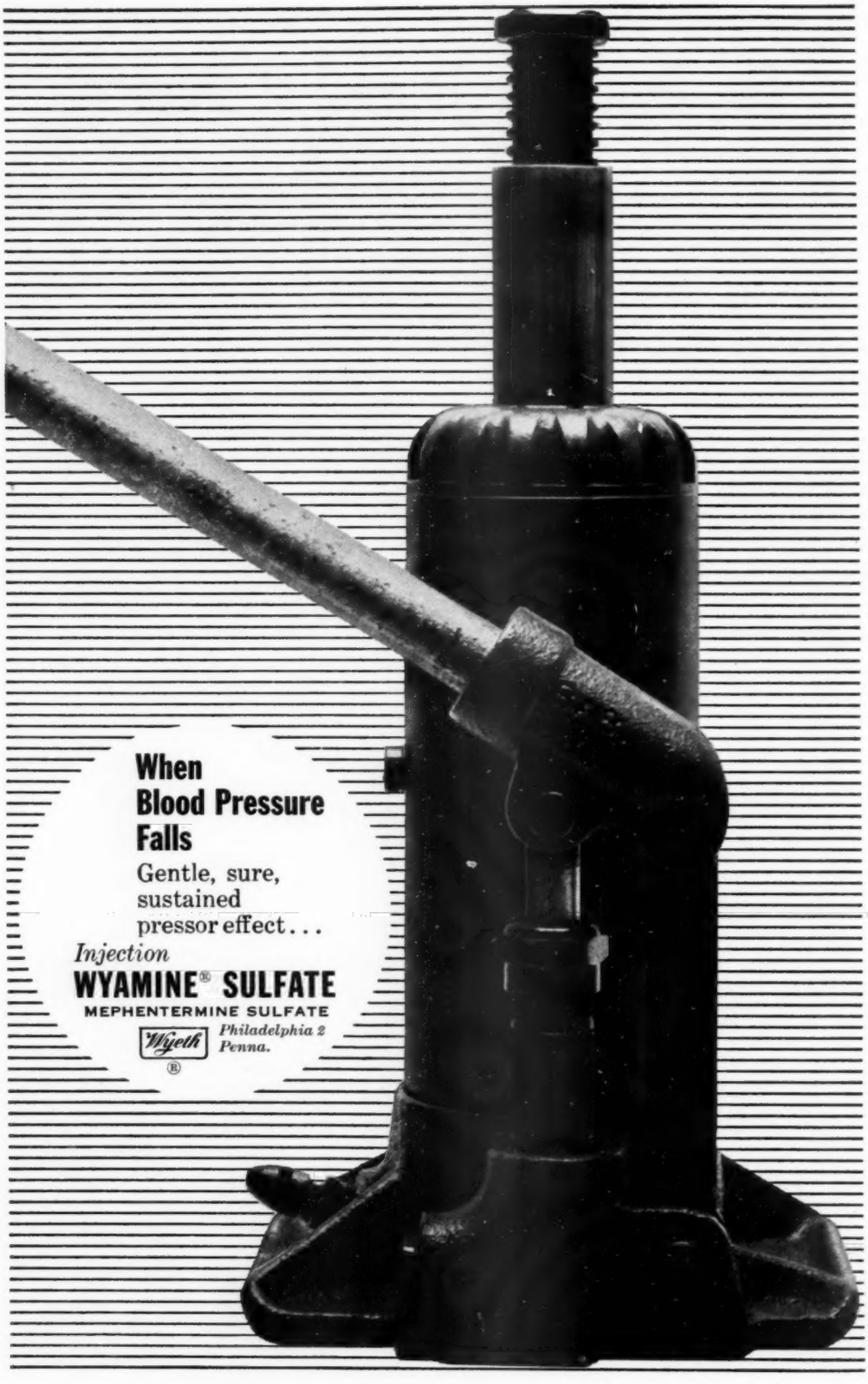
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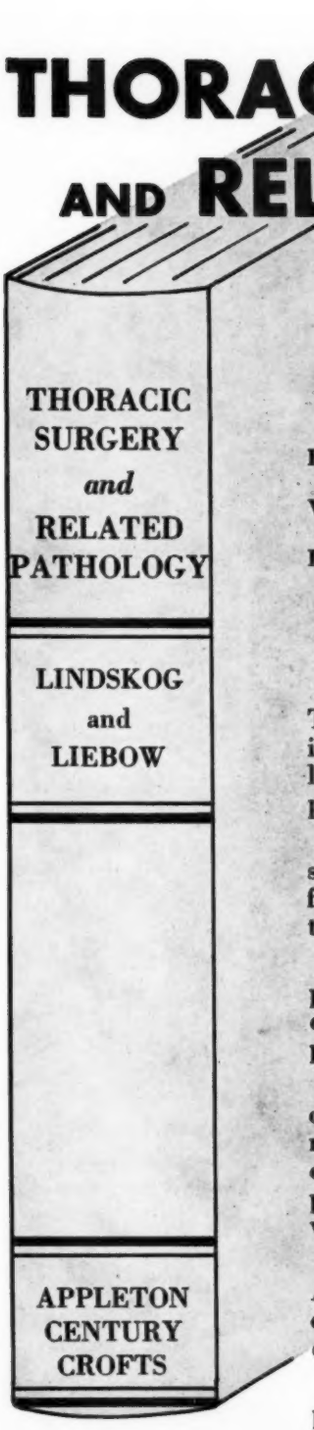

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AND **AVERILL A. LIEBOW, M.D.**
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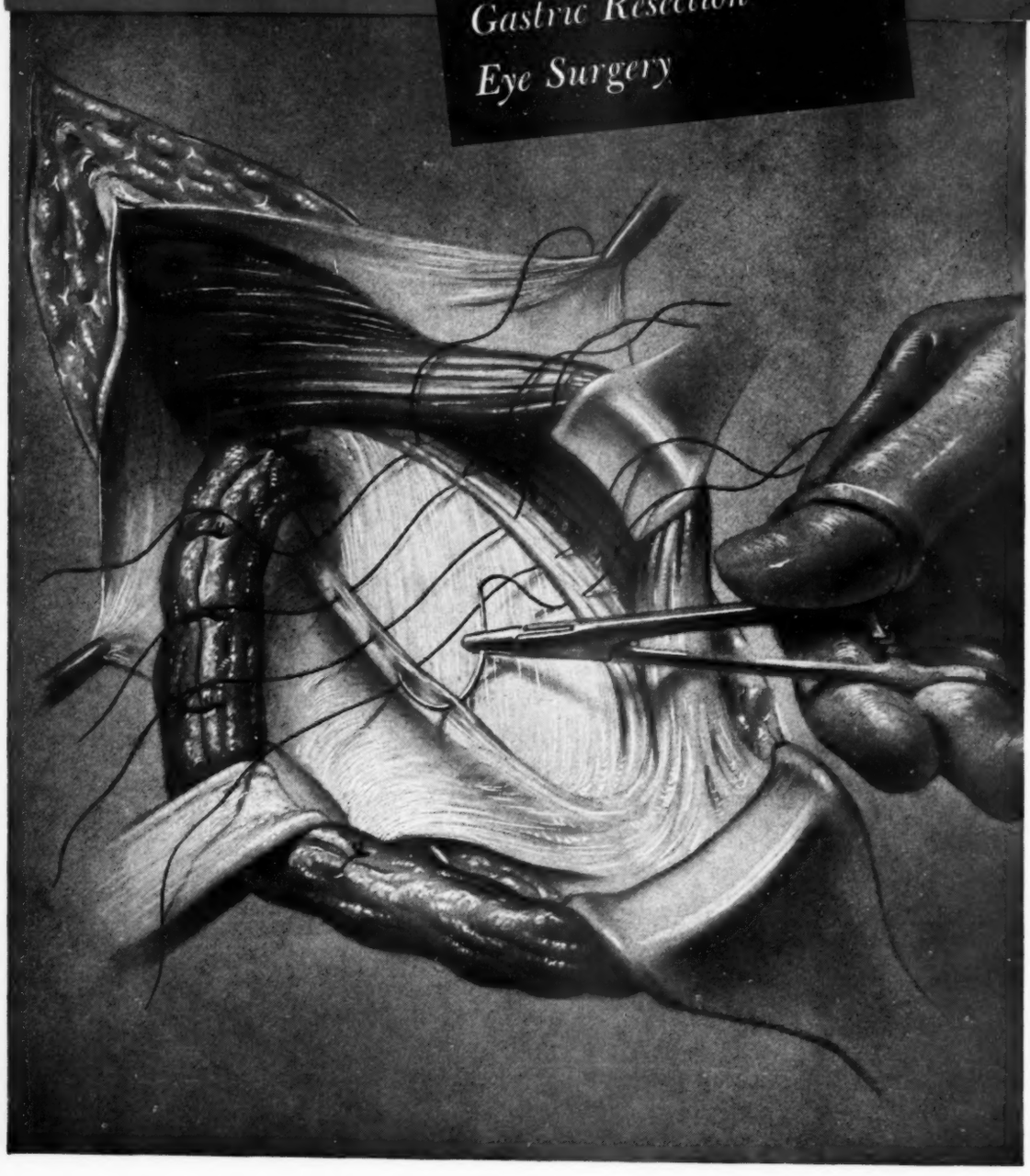

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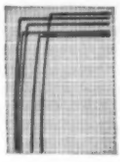

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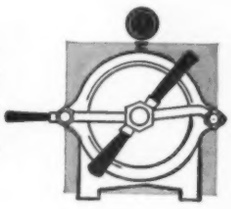

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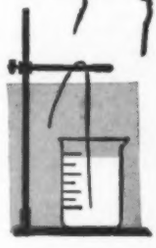

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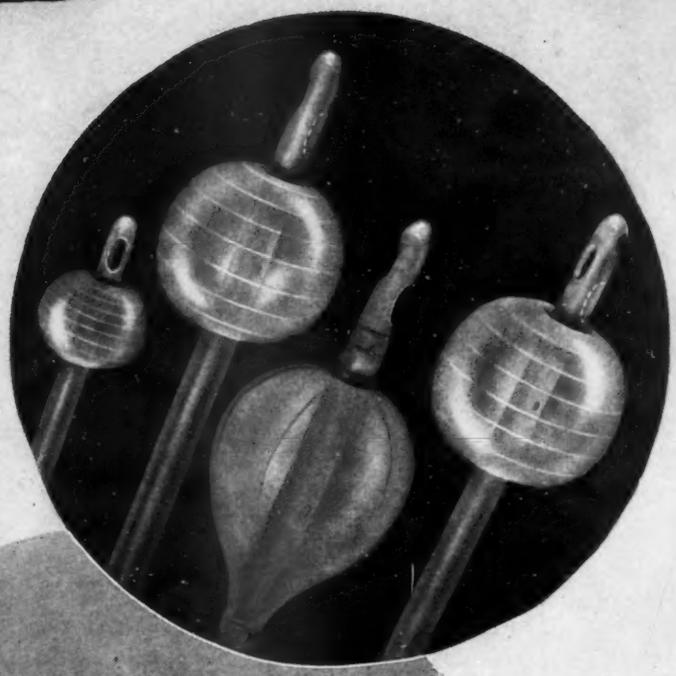

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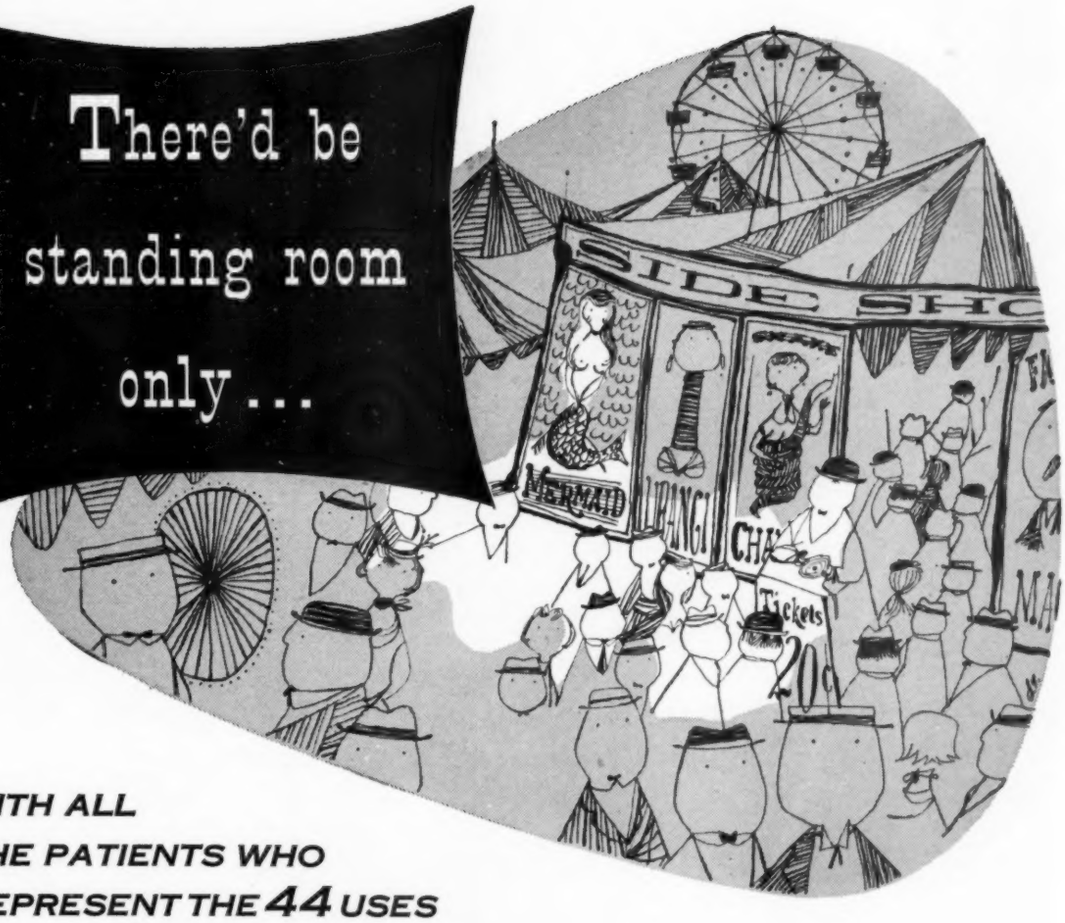

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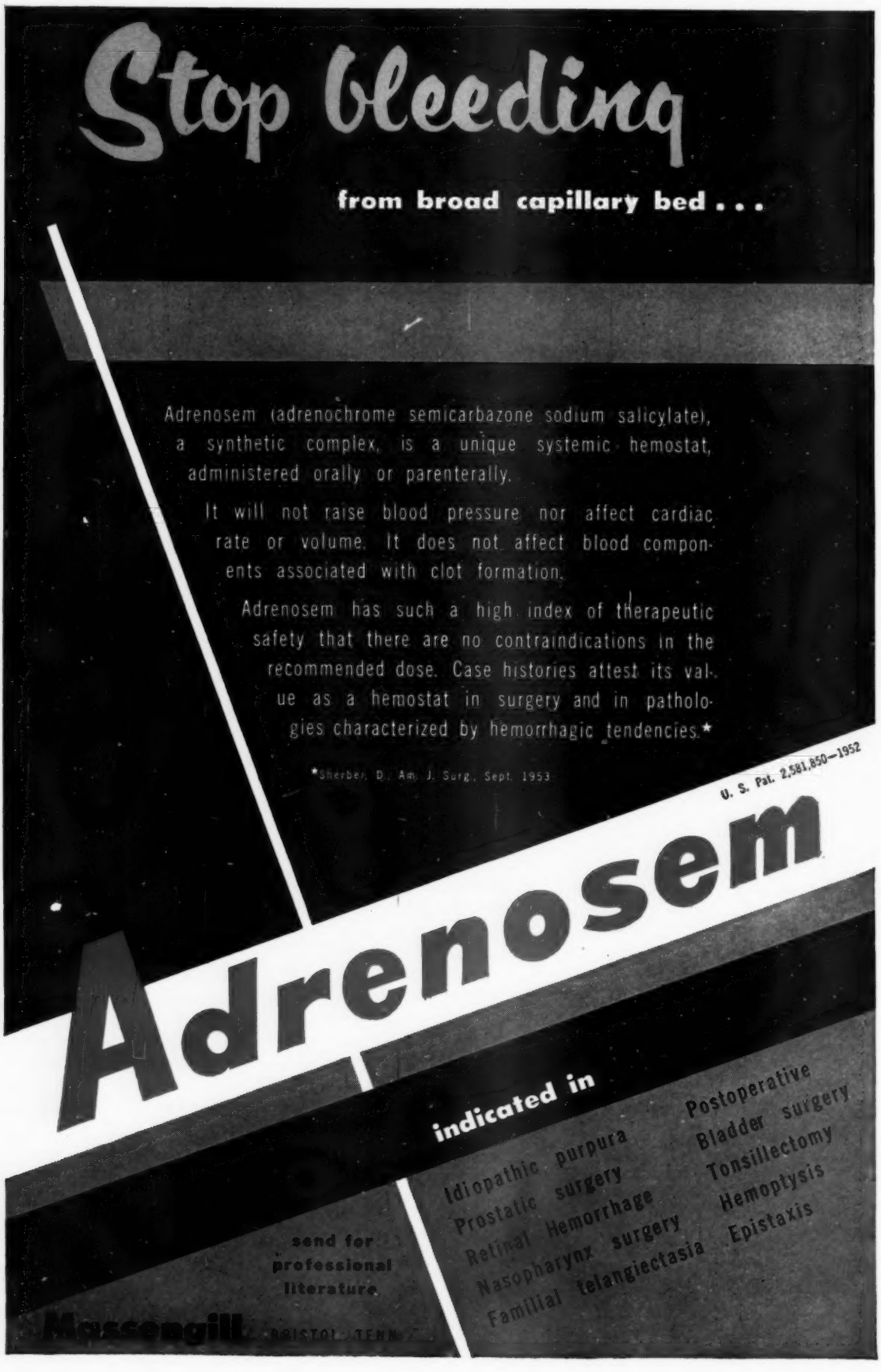
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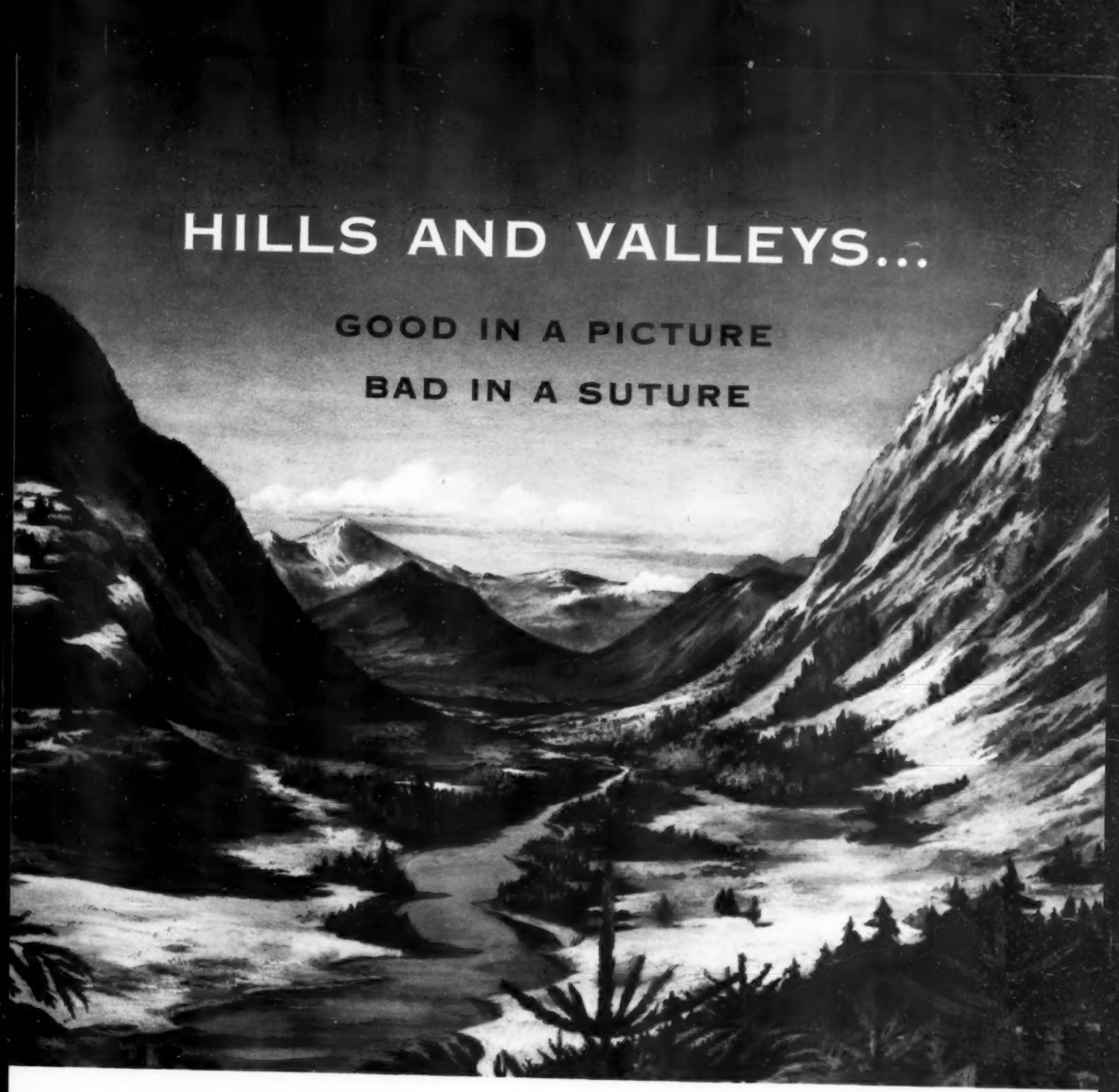

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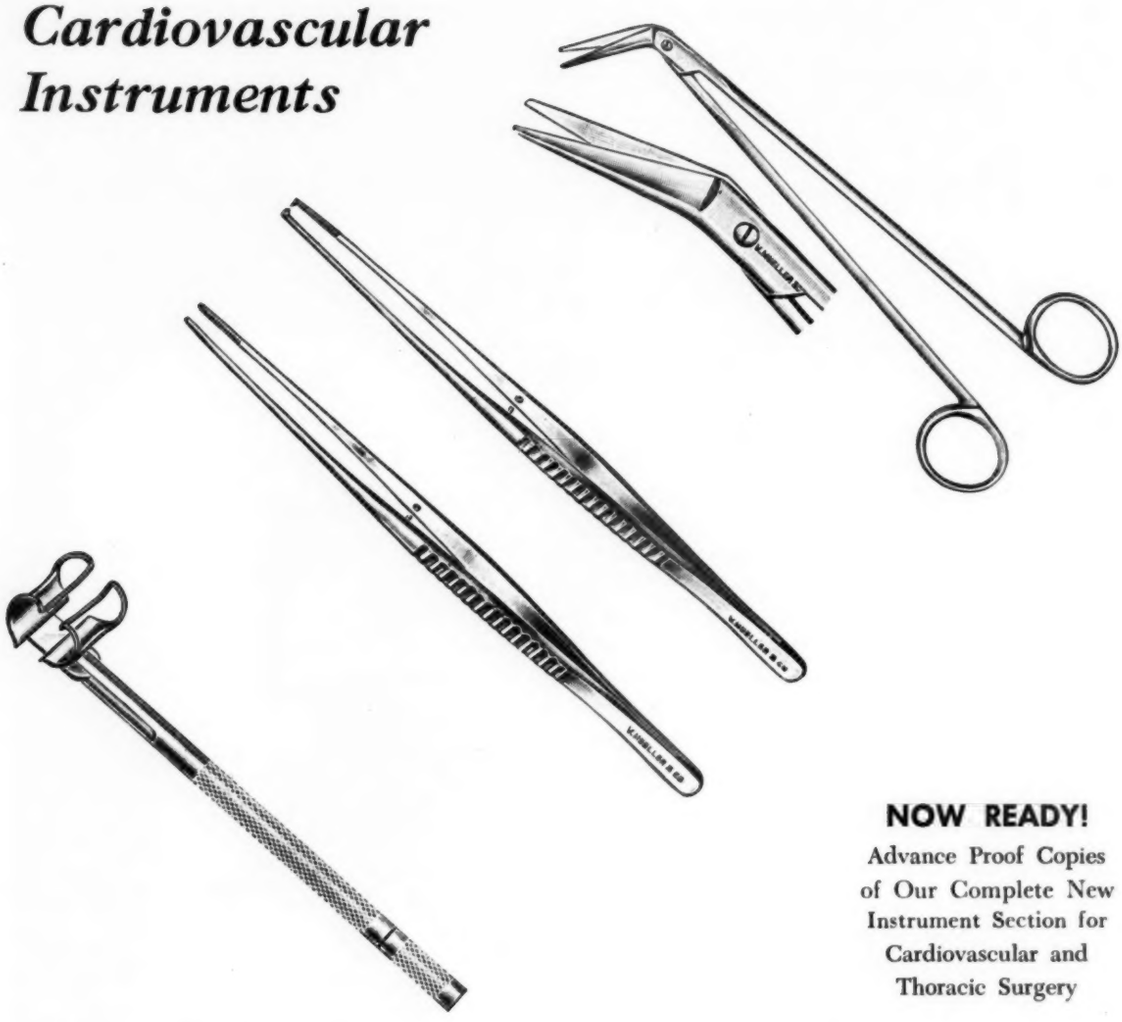

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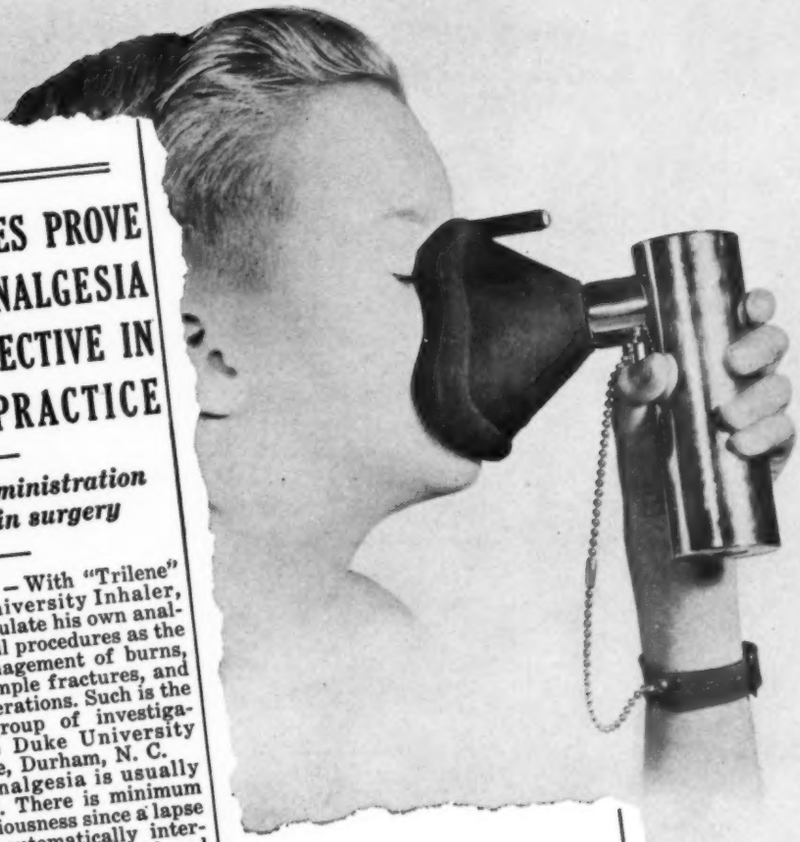

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1. Stephen, C. R., Nowill, W. K., and Martin, R.: Anesthesiology *13*:646 (Nov.) 1952.

2. Pickrell, K. L., Stephen, C. R., Broadbent, T. R., Masters, F. W., and Georgiade, N. G.: Plast. & Reconstruct. Surg. *9*:345 (Apr.) 1952.

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Hull, H. C., and Barnes, T. G.: Ann. Surg. 133: 644-649, 1951.

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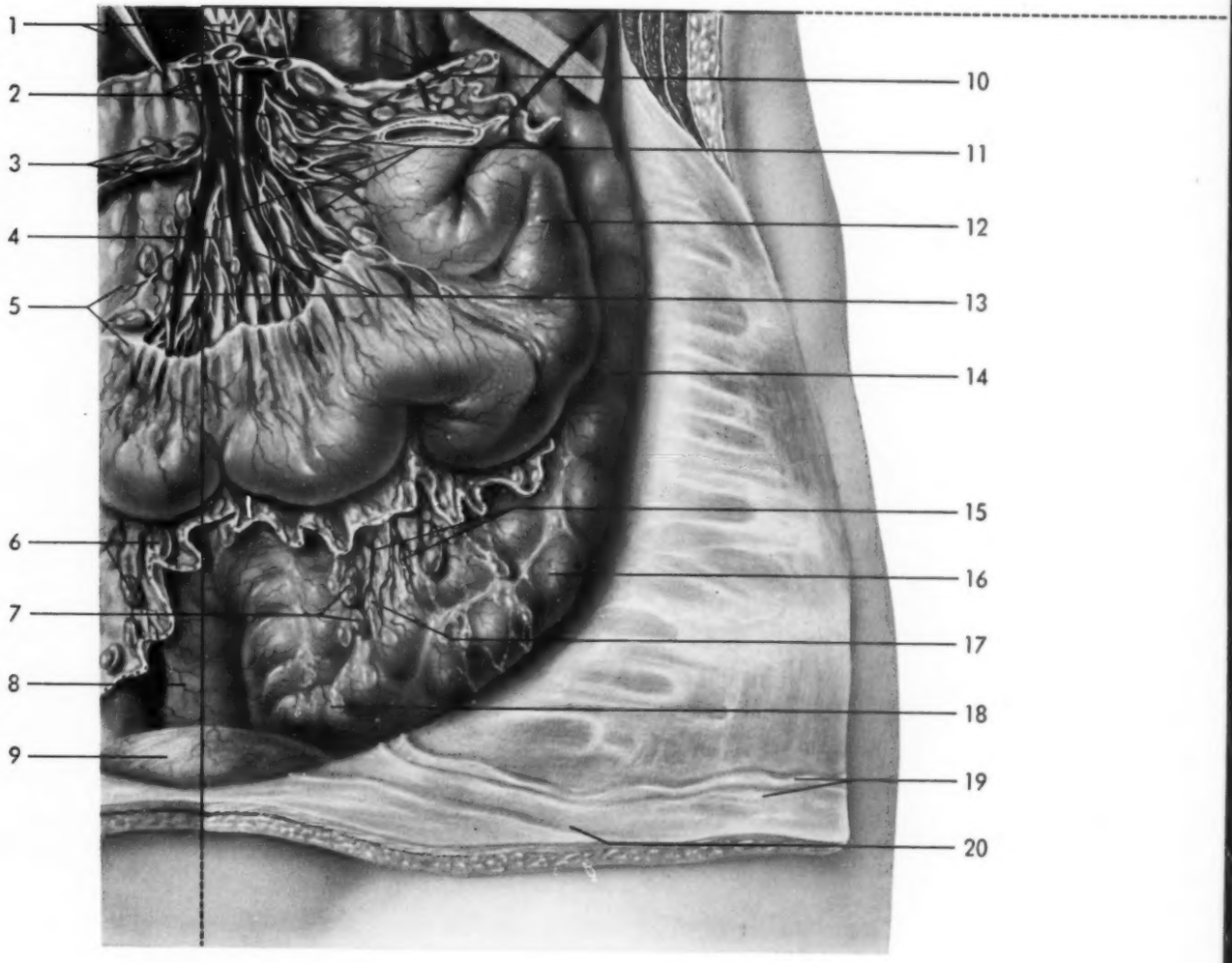

1 Vena cava, aorta and abdominal aortic plexus

2 Branches of superior mesenteric artery and vein

3 Ileocolic lymph node and ileocolic artery and vein

4 Sympathetic abdominal plexus

5 Mesentery

6 Mesenteric lymph nodes

7 Mesocolic lymph nodes

8 Rectum

9 Urinary bladder

10 Inferior mesenteric vein, left colic artery and ureter

11 Intestinal arteries

12 Ileum

13 Intestinal veins

14 Descending colon

15 Branches of sigmoid artery and vein

16 Iliac colon

17 Mesocolon

18 Sigmoid colon

19 Epigastric artery and vein

20 Lateral umbilical ligament

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In the years beyond fifty, as well as before, continuous adequate protein nutrition remains an absolute necessity for maintenance of a normal concentration of plasma proteins and, in turn, a normal osmotic pressure of the plasma.[6] Even more pronounced in the aged than in younger persons are the ill consequences of hypoproteinemia—edema, decreased resistance to generalized infection, retarded bone healing, and poor wound healing.[7] Furthermore, dietary protein is essential for the continuous chemical regeneration of cell protein in the prevention of abnormal tissue wasting, one of the most characteristic and obvious changes in the geriatric patient.[8]

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REFERENCES

1. Freeman, J. T.: Basic Factors of Nutrition in Old Age, Geriatrics *2*:41 (Jan.-Feb.) 1947.
2. Sherman, H. C.: Chemistry of Food and Nutrition, ed. 8, New York, The Macmillan Company, 1952, p. 208.
3. Tuohy, E. L.: Feeding the Aged, J.A.M.A. *121*:42 (Jan. 2) 1943.
4. Ohlson, M. A.; Roberts, P. H.; Joseph, S. A., and Nelson, P. M.: Dietary Practices of One Hundred Women from Forty to Seventy-Five Years of Age, J. Am. Dietet. A. *24*:286 (Apr.) 1948.
5. McLester, J. S., and Darby, W. J.: Nutrition and Diet in Health and Disease, ed. 6., Philadelphia, W. B. Saunders Company, 1952, p. 222.
6. Madden, S. C., and Whipple, G. H.: Amino Acids in the Production of Plasma Protein and Nitrogen Balance, Am. J. M. Sc. *211*:149 (Feb.) 1946.
7. Fishback, F. C.: Surgery in the Aged, Clinics *4*:1250 (Feb.) 1946. Zintel, H. A.: The Role of Nutrition in Preoperative and Postoperative Care, Am. J. M. Sc. *207*:204 (Feb.) 1944.
8. Kirk, J. E.: Nutrition and Aging, Nutrition Rev. *9*:321 (Nov.) 1951.

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write for **samples** *and literature*

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1. Behrman, H. T., Combes, F. C., Bobroff, A., Leviticus, R.: Ind. Med. & Surg. 18:512, 1949.
2. Turell, R.: New York St. J. M. 50:2282, 1950.
3. Heimer, C. B., Grayzel, H. G., and Kramer, B.: Archives Pediat. 68:382, 1951.

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Deucher, F.: Schweiz. med. Wchnschr. 82:1 (Jan. 5) 1952.

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Farley, W. J., Konieczny, L.: J. Pediat. 42:177 (Feb.) 1953.

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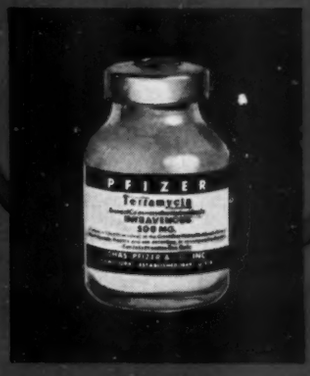

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Reiss, E., et al.: A. M. A. Arch. Surg. 64:5 (Jan.) 1952.

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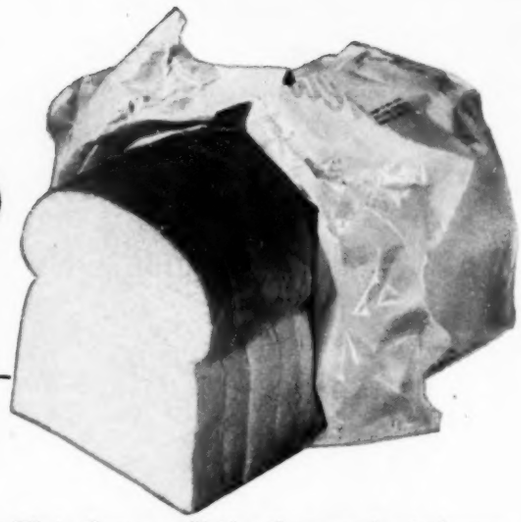

Some twelve years ago the baking industry began large-scale, nationwide commercial production of enriched breads. Today such breads represent about three-fourths or more of all the marketed white bread in the United States,[1] and rank high among the foods which contribute essential nutrients—in important amounts—at low cost—to the nutrition of the American people.[2]

It is not so long since deficiencies of certain B vitamins and iron were regarded as sufficiently widespread in the United States to merit serious attention. By providing broad distribution of these important nutrients in effective amounts, commercial enriched breads have contributed notably to reducing the incidence of these deficiencies,[1] as reported for instance among patients of charity clinics throughout the country.[3] It is authoritatively believed that the enrichment of bread has improved the health of a large segment of our population.[4]

Per pound, enriched breads today contribute—as required by government definition and standards of identity[5]—at least 1.1 mg. of thiamine, 0.7 mg. of riboflavin, 10 mg. of niacin, and 8 mg. of iron. Thus they are distinctly superior to home-made as well as bakers' white breads of former years.

Each pound of commercial enriched breads contributes also 39 Gm. of protein—wheat flour protein supplemented with milk protein—biologically applicable to the growth processes as well as to tissue maintenance.[2]

Another significant contribution of such breads is 400 mg. of calcium per pound.[6] Last not least, and rather to be praised than to be deprecated, is the low-cost contribution of calories which bread makes to energy needs.

The appended table shows the important amounts of six essential nutrients contributed by six ounces of marketed enriched breads. The table also shows the notable percentages of the National Research Council's recommended daily allowances this small amount of present-day enriched breads represent.

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NUTRIENTS AND CALORIES CONTRIBUTED BY 6 OUNCES OF ENRICHED MARKET BREADS AND THEIR PERCENTAGES OF RECOMMENDED DAILY DIETARY ALLOWANCES*

Nutrients and Calories	Protein	Thiamine	Riboflavin	Niacin	Iron	Calcium	Calories
Amounts	14.5 Gm.[7]	0.41 mg.[7]	0.26 mg.[7]	3.8 mg.[7]	4.5 mg.[6]	150 mg.[6]	468[7]
Percentages of Allowances	21%	34%	14%	32%	38%	15%	20%

*Daily dietary allowances recommended by National Research Council for a sedentary man (154 lb.).

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1. Geddes, W.F.: Cereal Chemists Guard Nutrition, Agricultural and Food Chemistry *1*:38 (Apr.) 1953.
2. Sherman, H.C.: Chemistry of Food and Nutrition, ed. 8, New York, The Macmillan Company, 1952, pp. 597-600; 646.
3. Flour and Bread Enrichment, 1949-50: Prepared by The Committee on Cereals, Food and Nutrition Board, National Research Council, 1950.
4. Sherman, H.C.: The Nutritional Improvement of Life, New York, Columbia University Press, 1950, pp. 86-87.
5. Bakery Products; Definitions and Standards of Identity: Federal Register *17*:4453 (May 15) 1952.
6. Data furnished by the Laboratories of The American Institute of Baking, Chicago, Illinois.
7. Watt, B.K., and Merrill, A.L.: Composition of Foods—Raw, Processed, Prepared; United States Department of Agriculture Agriculture Handbook No. 8, 1950.

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Sadove, M. S., Nelson, J. T., and Unna, K. R.: Comparative Evaluation of Curare-Like Drugs, Current Res. in Anesth. & Analg., *30*:221, 1951.

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Sixty-second Year of Publication

VOL. LXXXVI AUGUST, 1953 NUMBER TWO

Editorial

INTRATHORACIC PROJECTIONS OF THYROID ORIGIN

GOITROUS masses that protrude through the thoracic aperture down into the chest have certain definite anatomic characteristics which are important factors to keep in mind in the surgical removal of these lesions. Curtis[1] has clearly divided projections through the thoracic aperture into the chest by defining the aperture itself. He describes the plane of the thoracic aperture as an imaginary one extending from the top of the first dorsal vertebra to the superior border of the manubrium and spreading out laterally over the first rib. Goiters protruding below this plane are classified either as deep cervical, partially intrathoracic or totally intrathoracic.

The deep cervical lesions are those masses with a lower portion which protrudes below this plane; on swallowing, however, the lowest projection may be elevated above the plane and palpated in the neck. The partially intrathoracic goiter extends into the chest and does not rise into the neck on swallowing; its lower pole cannot be palpated. Such a protruding mass sometimes becomes fixed against the first rib by a deep groove and does not move freely up and down on swallowing or respiration. This fixation often causes respiratory difficulty, owing to deviation and angulation of the trachea. The totally intrathoracic goiter is one that is completely within the chest. It is rare, although more common in advanced age.

The anatomic relationship of these intrathoracic lesions is of surgical importance. These protrusions arise from either of the lower poles or the isthmus of the thyroid gland and they may be discrete or multiple adenomas, or degenerating cysts. These masses are prevented from enlarging outwardly by the bony structures of the thoracic cage and by muscle attachments. The line of least resistance in their development is through the thoracic aperture down into the chest and the act of breathing and swallowing aids materially in directing these lesions in their downward descent. As they descend into the chest, they push with them the cervical fascia and mediastinal structures and carry downward their blood supply from the superior and inferior thyroid arteries. They, therefore, are surrounded by a well defined fascial covering and retain their original blood supply from above. These factors are most important to remember in the surgical removal of intrathoracic projections.

The relative position of these masses is of some importance from the surgical standpoint. The great vessels of the mediastinum are different on each side. On the right side are the common carotid and innominate arteries, and on the left, the aorta and common carotid. The right common carotid artery originates from the innominate artery and it is closer to the lower pole of the thyroid gland than is the common carotid on the left side. Therefore, the masses are largely directed to the left by the right carotid innominate artery and vein. They may develop anteriorly or posteriorly to the

[1] Curtis, G. M. Intrathoracic goiter. *J. A. M. A.*, 96: 737, 1931.

vessels, and the terms antivasal and postvasal designate their relative positions. The terms substernal and lateral likewise designate their anatomic relationship.

The position of the trachea and its relation to the goitrous mass is most important. Lateral as well as anterior posterior roentgenograms should be made in order to determine this relationship and to establish the contour of the trachea.

The symptoms are rarely the toxic manifestations seen in cervical nodular goiter. They are largely the result of mechanical factors and relate to the respiratory or vascular structures pressed upon. The trachea is usually pushed to one side and markedly narrowed from pressure, resulting in dyspnea, cough and emphysema. Sometimes when the trachea or bronchus becomes occluded with mucus, violent efforts at respiration occur. The trachea may also be markedly flattened by pressure from behind or in front. Change in body posture may angulate and increase tracheal pressure, causing respiratory effort. A narrowed, deviated trachea reduces oxygen intake, resulting in increased cardiac and respiratory effort, thus adding to the strain of a heart already affected by thyroid disease. A sensation of pressure, a tightness in the chest and difficulty in swallowing may not be pronounced however, as very large growths seem to accommodate themselves with a minimum of discomfort.

Pressure upon the large vessels, especially the internal jugular veins, may produce marked enlargement of the veins of the chest and neck, with great swelling of the soft tissues from back pressure and increased venous stasis. Sudden release of this pressure may result in severe and sudden alteration of cerebral circulation. Lahey has suggested it would be wise for some time before removing the goiter in severe cases to divide the pretracheal muscles and at times disarticulate the manubrioclavicular joint in order to afford gradual release of intracranial pressure.

It is extremely valuable to introduce a catheter into the trachea if the goiter is large and there is constriction and deviation of the trachea. Large goiters extracted through a tight outlet may so obstruct the trachea that serious respiratory difficulty may develop during the process of delivery. With an intratracheal catheter in place, a large intrathroacic goiter may be delivered through the thoracic aperture with little or no embarrassment to respiration. The use of helium and oxygen will permit a larger amount of oxygen to be delivered through a narrow, constricted trachea and thus materially overcome anoxemia.

Tracheal collapse is usually associated with bilateral nerve injury. If the trachea is deviated and soft, collapse is more likely to occur. I do not think the trachea will collapse, even though it is markedly narrowed and deviated, unless there is bilateral nerve injury. It is common observation that when the pressure upon such a trachea is released the caliber and position of the trachea soon return to normal. As mentioned by King,[2] with double recurrent-nerve injury there is a blocking of the larynx, which results from atmospheric pressure creating a partial vacuum in the trachea upon respiratory effort. This will not occur during operation if an intratracheal catheter is in place but might occur after removal of the catheter, if there is bilateral nerve injury. Exposure of the nerve at the time of operation protects its integrity and prevents such a catastrophe. We make this exposure routinely in thyroid surgery and have reduced nerve injury nearly to a minimum—a small fraction of 1 per cent.

The operative approach for an intrathoracic goiter is a low collar incision. It is rarely necessary to enlarge the thoracic opening by undertaking any surgical procedures upon the bony structure. It must be remembered the blood supply originates from above and passes downward into the chest with the descent of the goitrous mass. Hemorrhage is controlled by first ligating the superior thyroid artery, after which a resection of the cervical thyroid from the trachea and division of the isthmus will facilitate the subsequent removal of the intrathoracic mass, by establishing mobility and more freedom of manipulation. The inferior thyroid and lateral vein are likewise ligated as they become accessible. Vascularity within the chest is limited, as the mass is surrounded by the cervical fascia and mediastinal structures which have been pushed down with the descent of the goiter.

Occasionally a large vein, usually the midthyroid vein has been pulled down into the chest with descent of the thyroid mass and it may be undetected and accidentally torn, resulting in deep profuse bleeding. The origin

[2] King, B. T. Intrathoracic goiter. *Northwest Med.*, 24: 619, 1925.

cannot be detected. Lahey[3] has ingeniously controlled this situation by doubly ligating and dividing the internal jugular vein and twisting the lower or distal segment until the open lumen of the bleeding vein is occluded. We have not encountered this misfortune but its management is well to keep in mind.

The intrathoracic mobilizing approach to an intrathoracic growth is best accomplished by passing the index finger from behind alongside the mass and freeing it posteriorly, laterally and ultimately anteriorly; at the same time gentle traction is made, working to the lowest point of the mass and lifting it out of the thorax, rather than partially freeing it and attempting to draw it out by traction. A considerable negative pressure is present which prevents the delivery of the goiter until air is permitted to pass between the capsule and the goiter. This procedure often markedly elevates the goiter and makes it more accessible. Forceful traction may pull on adherent bands attached to the side of the goiter and increase its anteroposterior or lateral dimensions, making delivery harder or impossible. Moreover, traction or adhesions may seriously damage some adherent blood vessel, injure the pleura, produce an angulation or tear into a softened trachea. The posterior approach affords more freedom of action by entrance through the soft areolar tissue near the tracheal groove than does an approach between the sternum and the growth. Hemorrhage is not great and is controlled by packing. Small spurting arteries should be carefully picked up and ligated. The cavity, though large, may almost immediately be eliminated by shifting of mediastinal structures and lung expansion. Adequate drainage should be established and maintained to prevent accumulation of serum, late infection and mediastinitis. Large unobliterated cavities should be packed or well drained to prevent bleeding, oozing and accumulation of body fluid. The recurrent nerve is usually pushed by the large goiter mass well into the groove between the trachea and the esophagus and is rarely injured if the capsule is carefully dissected and the tumor mass gently manipulated. The nerve should be exposed and observed under direct vision during manipulation and extraction of the goitrous mass.

The removal of large cysts may be facilitated by evacuation of the contents. Gentleness is essential throughout the operation. It lessens the possibility of deep hemorrhage from adhesions to deep vascular structures and reduces the possibility of tracheal compression, angulation or perforation. After removal of the tumor the trachea returns to its normal position.

Maintenance of the contour and continuity of the trachea, control of hemorrhage and preservation of the recurrent laryngeal nerve are essential in all thyroid surgery.

Forceful and hurried delivery of the gland into the field of operation may lead to a serious complication. Adequate exposure and anatomic dissection under direct vision are essential in order to minimize the danger of a surgical tragedy.

CLAUDE J. HUNT, M.D.

[3] Lahey, F. Intrathoracic goiter. *S. Clin. North America*, 16: 1613, 1936.

Original Articles

THE USE OF PROSTHESIS FOR LIMB DEFECTS IN CHILDREN*

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THE problem of limb prosthesis for young children is of interest because children have been approached late, reluctantly and with comparatively crude materials. In very recent years there has been some recognition that new materials are available which may greatly simplify the problem and facilitate the application of prostheses at a very early age. If one were to say that no effort at all had been made to assist the young child by early prosthetic application, a great injustice would be done to Dr. Henry Kessler in New Jersey, to the Michigan State Crippled Children's Commission's Amputee Program centered in Grand Rapids, and to some of the commercial prosthetists such as Hanger in Saint Louis, Missouri, and to a number of other workers in this field. Generally speaking, it is still true that artificial limb experience has been built around the adult, both veteran and civilian, and that the emphasis has been and continues to be on use of non-castable materials such as willow wood. There is as yet no active research center devoted to the medical, psychological and engineering aspects of the problem in infancy and very early childhood, and this is a field in which there is much yet unexplored. Plastic laminates and materials similar to pros-to-form plastic may enable one to have greater strength, less weight and more perfect fitting for the young child than can be obtained with conventional materials.†

Children are placed in the position of needing an artificial limb by reason of several major events. One of these is trauma, and automobile accidents and contacts with other heavy vehicles take a toll. Farm accidents continue to plague us with important disabling injuries in young children exposed to heavy machinery.

The largest single group of cases requiring prosthesis is presented to us by reason of congenital deformity, and this is certainly the principle cause in the youngest age group. Two situations are encountered; one in which the child has amelia, lacking either part or all of an extremity, and the other in which deformities are present in which elective amputation is necessary before any successful prosthesis can be applied to assist in the rehabilitation of the child.

A third group may be assigned to disease in which removal of an extremity becomes necessary in the presence of certain types of cancer, or by reason of difficulties arising in the course of osteomyelitis. On a rare occasion someone is seen who has disabilities arising from poliomyelitis that do not lend themselves to any solution other than amputation of a useless, deforming member. These three major categories will account for almost all of the child amputees.

LOWER EXTREMITY PROSTHESIS

Not too rarely one will see a newborn infant in whom one or both legs are absent or rudimentary in some important degree. Any major metropolitan community will have a number of such children either within its confines or entering that city for care. There has been a marked reluctance on the part of the physician and failure on the part of the prosthetist to approach the young infant with any constructive *early* program for restitution or rehabilitation. We have within the past three years seen a commercial prosthetist tell the parents of an active male infant to "bring him in when he is five years old" for the first attention to the

† CHITTENDEN, R. F., MOTIS, G. and SPIERS, D. Prosthesis for infants. *Crippled Child Magazine*, February, 1951.

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problem of artificial limbs. As we have already reported, experimental prosthetic application was made at ten and a half *months* of age and the child was walking *alone* at fourteen months of age, a fact that is documented by motion picture film made at that age. From the standpoint of the physical advantage to the child and the psychological advantage to the parents, early prosthesis has in this instance been a great boon. Rehabilitation has been a fact and the child is competitive with the other children under two years of age in his community. If one were to follow the conservative attitude of the commercial prosthetist, this child at four years of age would have been sitting on the floor asking, "Mummy, where are my feet?"

We are particularly impressed with the materials used by Northrop Aviation Corporation at Hawthorne, California in their research program. The_e materials were light, strong plastics and were castable. Limb contours were recorded in plaster cast impressions and master molds were then made by filling the plaster "wraps," so that a plaster structure was produced in exact replica of the stump of the limb to which prosthetic application was to be made. The socket of the limb was then fashioned over this mold by application of plastic materials. Such material could be either a homogeneous plastic such as pros-to-form,* or a laminate built up from successive layers of plastic and cloth. In this process only inexpensive plaster bandage is required in the initial stages; the master mold can be made in a few hours at most and the process can be arranged to proceed at a very rapid rate. Such a socket on completion is strong, light, well tolerated in any direct skin contact, requires no internal or external finishing lacquer and can be duplicated exactly from the master mold. (Fig. 1.)

One recognizes, of course, that the young child can be approached using conventional materials, i.e., willow wood, leather and the metal fittings. As a matter of fact that has been done, and a recent illustration in the *Crippled Child Magazine* shows a little girl at fourteen months of age standing in her as yet unfinished leg prostheses. The idea of early use of the artificial limb, particularly the leg prosthesis, has our most hearty endorsement, whatever the means. We still wish to emphasize that with the work at Northrop and in arm pros-

* Pacific Moulded Products Co., Los Angeles, Calif.

FIG. 1. Below-knee prostheses fabricated from plastic laminates and employing insert sockets of plastic.

thesis research at the University of California at Los Angeles in the School of Engineering, the use of plastic laminates has been unusually adaptable to children and to difficult situations in adults, and that the adult arm program at the University is now based completely on the use of plastic laminates. It must be remembered that if we elect to work with willow wood, we shall have to fit by approximation rather than by exact casting and that surface-finishing technics must be employed before the limb is completed for use. All of this takes time, which is important in calculating cost to either the fabricator or the limb wearer.

The problem of strength and weight saving is not alone a matter of laminates versus wood; the metals used in hinges or bearings are very important and the development of modern strong light alloys with very special advantages to the field of limb prosthesis must not be overlooked.

Insofar as the United States is concerned, the amputee needs for leg prosthesis are met with non-castable materials and one may safely say that in this country willow wood is mainly used. This situation is easily understood when one considers that the commercial technician is familiar with the material, his apprentice is trained with it and in limb shops the fabricators work with such materials. Research pro-

grams are set up to work hand in hand with the association of limb manufacturers in exposing selected members of the association to the processes and technics employed in research projects; and when such observers are present at a center such as the one at the University of California's Westwood campus, they will see limb fabrication undertaken with exclusively castable materials. This is an arm research center and a comparable development of the use of plastic materials in leg prosthesis cannot at present be identified. In the leg research program at the University of California's San Francisco center the emphasis has remained on conventional materials and they are not as yet making extensive use of plastic laminates. Because chronologically leg replacement is being approached at an earlier age in the child's life than is arm prosthesis, we shall turn first to consideration of the young child leg-amputee, using the word amputee to cover any individual requiring the use of an artificial limb in rehabilitation.

To indicate how confusing some aspects of this problem may be, one may begin by discussing the preparation of the amputee for use of the prosthesis. If we are talking about a six year old child who has lost one leg above the knee from trauma, we might take rather literally the recently published remarks of one capable physiotherapist who says that crutch walking is definitely part of the preliminary training of the amputee and should be developed quite fully before any use of the prosthesis is attained. As we work toward an earlier age group and approach the child who has congenital absence of a portion of an extremity, the crutch walking so strongly advised may prove to be either impossible or unnecessary, or even inadvisable. We are thinking of three children each fitted with a prosthesis for a leg defect at about twelve months of age. Each of these children was walking alone at fourteen months of age. We are at a loss to see why we should have taught them to use crutches first or that such a sequence would have made their acceptance of the prosthesis easier. Crutch walking was not needed, might have been very difficult to attain at age one year and could have delayed the rehabilitation these children have attained. We are not perfectly assured on all of the following points that we bring to the reader's attention but it is possible that most of them are correct if they are applied to the group between ten and eighteen months of age. It is not presumed that much preparation is possible for these infants. It is likely that if they are comfortably fitted with a lightweight prosthesis and are inclined to want to walk, they will go ahead and do so. This has been true with each of the three little boys mentioned heretofore. It is entirely possible that regardless of whether the limb is made from wood or from plastics, if it is not too heavy and is well fitted, the skin tolerance will be good because the child is light and does not impose the same stress on the contact areas in the prosthesis that would be present with a heavier individual. Rules about the amputee removing the limb when sleeping may not necessarily apply for the infant; and if the weight, fit and skin tolerance of the prosthesis permit and the child prefers it, a limb might be worn all through nap time. This was true with one boy who had a bilateral leg defect.

The favorable effect of the lesser weight in the infant amputee may serve to suggest some possibilities of end-bearing under conditions that would not be tolerated by the adult, and also about weight bearing by a child with a congenital hip dislocation because of this same factor.

One of the factors that has worked against prosthetic application in infancy has been an overemphasis on growth. It apparently has been assumed that the child would outgrow a limb so often that it was not a good idea to get an early start. Actually it is much less of a problem than one might imagine. Suppose we are dealing with a single BK, i.e., a child with a loss of one leg below the knee, from birth, and that this child has a stump long enough to permit "normal" prosthesis. At birth this child was 20 inches long, at one year of age he was 30 inches long and at five years of age he will be 44 inches tall. It is not necessary to consider growth before walking age, so our increment problem is one in which we are dealing with 14 inches in four years or $3\frac{1}{2}$ inches per annum. Growth occurring in the trunk, neck and head is to be subtracted from this figure, and growth in the functioning epiphyses of the affected limb is also to be subtracted from the $3\frac{1}{2}$ inches of total annual growth. Even though the distal tibial center is absent and the proximal tibial center does nothing to increase the standing height of the limb wearer, both the proximal and distal femoral centers are present and

growth accomplished through their activity may also be subtracted from the annual growth. We may be dealing with less than 2 inches annually, not all of which need be met by prosthetic replacement. Unless sudden weight gain occurs, circular or circumferential growth appears to be slow and revision in the prosthetic set-up for that reason will be infrequent.

Remarks about good tolerance of the limb in infancy because both prosthesis and wearer are light in weight apply to the matter of support and attachment. The modifications of the Maehle limb in which thigh lacer and hinges are omitted for the BK amputee is not to be decried in the young child. It may be possible to devise means of support with very light harness over the shoulder, garters and vinyon-N tubing as a means of support for a limb, whereas equally flimsy attachment in the adult would be relatively less practicable. When we say "may be possible," we are speaking about such lightweight harness as if it were not actually in use with children when in reality we know that very simplified support mechanisms are indeed used successfully. There may be contraindications to the Maehle limb for other reasons, including lack of stability at the knee, abbreviated BK stump or likelihood of fracture through the distal femur due to stresses applied at the time of a fall.

The matter of wear and tear on the artificial limb is roughly analogous to the brace problem. The brace does not exist that would be strong enough to withstand the strains of use and misuse that a six to twelve year old child can inflict on it and still be light enough to be entirely practical. This situation may be subject to improvement with some of the newer alloys but failure seems destined to occur with any brace or prosthesis in time, usually long before the device has been outgrown. The problem is not made easier by the complete lack of respect that the child employs in care for the device.

Experience seems to suggest that the combination of the strong plastic laminates and very well chosen metal fittings may offer some improvement in the situation. One child, who was a fairly heavy twelve year old and fond of horseback riding, was accustomed to wearing her leg prostheses under conditions of terrain that were distinctly rugged in comparison with a gait-training gymnasium. She was able to use such limbs for thirty months without major

FIG. 2. Above-knee suction socket prosthesis fabricated at Northrop Aviation Corporation at Hawthorne, California, 1949.

replacements. It is apparent that the cracking of the limb shaft that occurs in willow wood is not encountered nearly as readily in a good plastic laminate, and that these materials are reliable when properly used. Mr. John Steensma of the Michigan program has given us some data on the cost of limbs and the outlay for upkeep and repair in their amputee center in Grand Rapids, and we presume that this would constitute a fairly good guide to the problem using conventional materials. They did indeed find a great need for maintenance work and their experience has been shared by all of those who deal with braces and artificial limbs when fitted to young, active children. The newer materials that we advocate cannot completely overcome the repair problem. (Fig. 2.)

The boy leg-amputee is fortunate. His trousers do a very good job in masking imperfections in his prosthesis, and a fairly clumsy limb used in conjunction with a tibial angulation problem in which the equinus-positioned foot has been retained can still pass relatively unnoticed under a trouser-leg. By the same token, a bolthead that shows around a joint in the prosthesis or imperfections in the surface finish of the limb have little or no significance. If the boy chooses to appear in trunks or a bath-

ing suit, all the unfavorable features of his prosthetic application come to light; and we believe that even in this male individual every reasonable effort should be directed toward rendering his prosthesis as inconspicuous as possible. Attention to the cosmetic aspects of this matter will be taken up at some length when we come to consideration of the schoolgirl amputee. This brings us to a much debated question in the surgical management of the deformity case. Just because the boy does not present a particularly bad appearance when his trousers are masking the artificial limb, should he be allowed to retain a useless, deformed foot which produces a grotesque appearance when he removes the prosthesis to go swimming? Would he not be more efficient mechanically, better fitted and a more acceptable individual generally with this odd, distorted foot structure out of the way? This is a very important matter and deserving of the utmost skill from the services of the psychologist, orthopedist and prosthetist. We have in mind one twelve year old boy with a foot in marked equinus, the most dependent portion being the great toe at all times. He is completely incapable of any real weight bearing on the structure, and it is not a good foot but one in which "ankle bone" elements are either fused or absent. With the prosthesis in place some weight bearing takes place at the level of the heel of the foot, in a rather insecure manner.

The question of amputation is being hedged in this and similar instances because hope is held out that with growth and maturity improvement may occur in this limb and because the boy at twelve years of age is regarded as very young. It is also possible that certain English reports that the BK stump tends to "wear out" over several decades of use and that some BK amputees have to be converted to AK stumps, enters into the decision to defer or avoid amputation. Our viewpoint on this matter is built around two points: (1) This is not a good foot structure and realigning it will not give us a good strong normal ankle; favorable end results cannot be forecast. (2) This child is much older in terms of his intellectual maturity and the likelihood of psychic trauma than anyone recognizes. Actually he would present a better appearance and could as an amputee think of himself as some counterpart of a war veteran, a deception that is forever denied him as long as this grotesque, useless foot is still with him. We would like to see this particular problem handled by amputation and fitting with a lightweight, well contoured prosthesis.

Other odd and challenging problems arise in connection with congenital deformities in which there is either absence of the femur or very rudimentary development of it, with either no head to articulate with the acetabular recess or apparently irreducible dislocation of a vestigial femoral fragment. The foot structure, if present, may lie approximately at the level of the knee of the opposite normal side and continue to interfere with application of a well fitting and well contoured prosthesis. Prosthetic application to such a situation is feasible; whether the foot is to be retained in view of its position and diminished usefulness will need to be decided on an *individual* basis, but it contributes little or nothing to the success of the child's use of an artificial limb.

A very challenging situation, fortunately rare, is that in which there is complete absence of a lower extremity. Examination of the medical literature will show that both unilateral and bilateral cases have been seen, with or without other associated congenital abnormalities. Our personal experience is confined largely to one very active and otherwise normal male who was first seen at about the age of three years. At that time he was large, well developed, progressed rapidly and successfully by hopping on his "sound" left leg and presented a complete absence of any right leg, so that no femoral fragment was present and no stump or movable segment was identified. Minor pelvic deformities were shown in x-rays of the affected side. A limb had been made for this lad that was a typical scaled-down version of the accepted prosthesis for the adult disarticulation case, with joints at hip, knee and ankle. The bucket at the hip level was small; and although he could stand in the limb, it was all too easy to lose in any attempt at walking and was immediately pulled off in crawling when the projecting foot of the prosthesis encountered any obstacle. Through the intervention of Mr. Motis, the engineer who was supervisor of the limb research program at Northrop, a revised socket was constructed with plastic laminations and this was carried past the midline. With the aid of this enlarged and more extensive bucket sufficient security was obtained so that walking became possible and the

boy made good use of this limb. It is interesting to note that although this was a rapidly growing child and we were confronted with complete absence of any growth centers on the affected side, the linear growth increment did not render this limb unusable. On the contrary, it was employed by the lad successfully for many, many months with comparatively minor changes to accommodate for his growth.

Because this active three year old, on inspection, looked as if he were more typically designed to progress on crutches than any child we have ever seen and because he was quite active without their use, the parents were anxious that he not use any type of walking sticks or crutch. They had recognized the possibility that it might delay or otherwise interfere with his acceptance of the prosthesis. With this we agreed and it is only now, as he approaches five years of age, that indoors he turns to a crutch device occasionally. At school he is completely dependent on his prosthesis and makes *effective use of it*. An identical disability in the right lower extremity is exhibited by another child, as yet not one year of age, who has other major defects in each of the rather rudimentary extremities.

An adolescent, age nineteen years, has been under observation after hemipelvectomy for a malignancy of the pelvis. This lad is a candidate for prosthesis, with the following objectives and limitations: The artificial limb for the disarticulation case can be modified to serve as a prosthesis in the hemipelvectomy with the understanding, of course, that this is a difficult problem. The "seating" for the socket of the prosthesis is generally not too stable; and whether or not some pressure is taken on the margin of the rib cage or a crutch-like extension is extended up into the axilla, this still remains a difficult prosthetic problem. Cosmetically the leg is advantageous. Walking without a cane cannot be promised, and the probability of tiring readily and the possibility of some falls all enter into our thinking when this type of patient presents himself.

The girl amputee in general (and those of the junior high school age group in particular) constitutes a very special topic by itself. Admittedly here is the most challenging problem from the cosmetic aspect. It is not going to do any good to turn to the thirteen year old girl amputee and promise her that we shall make a better limb for her or give her a better cosmetic

FIG. 3. Below-knee limb showing insert socket displaced out of the shell of the plastic leg.

set-up when she is older. There is no time in her life when she will be more intensely interested in looking like the other girls in her school group and be more unhappy over any deviation from normalcy than her physical status produces. For this reason we must not only have a good mechanical set-up with strong, well fitted limbs, but also we must take the trouble to make this cosmetically acceptable regarding color and contour and general naturalness of the prosthesis. Failure to recognize this state of affairs will be tragic in its results to the schoolgirl amputee.

We have had experience with several children in this age group, including one girl who is actually part of our own household from time to time. She is now fourteen and a half years of age, and we have been able to observe her from the age of ten sufficiently closely to be aware of many details of the problem. She became a BK right and AK left amputee at about fourteen months of age through trauma and has been walking on two artificial limbs since the age of three years. Her present prosthetic set-up was designed by Gilbert Motis and was executed for her at Northrop when she was about twelve years of age. These limbs are very largely built up from the plastic laminates, with a suction socket on the AK and an insert socket on the BK limb. The below-knee portion of the leg, for each limb, has been made up from plastic laminates and contoured to reproduce the leg contours of a selected model,

whose body build was comparable to that of the patient. These rather well contoured limbs were fitted with Trautman two-cable ankles that have adjustable cable tensions to control the lateral inclination of the ankles. The surface coloring of the limbs is produced by application of a rubber-base paint which presents a pleasing imitation of skin coloring. The BK limb she uses is light and well fitted, and no thigh lacer or hinges are employed. It is held on by the use of vinyon-N tubing which is pinched into the space between the limb and the insert socket and is attached above to a garter belt. The tubing bridges the area between the upper margin of the BK limb and the garters, and provides a stable support in which no piston action is observed because the garter attachment provides tension in support of the limb through all phases of the walking cycle. This set-up enables her to be a good "bobby-soxer," which is definitely our objective for this age group. (Fig. 3.)

We have attempted to describe the major features of this prosthetic application in some detail because it seems so unusually simple and because it is singularly well suited to the schoolgirl.

Congenital deformities that are handled by the wearing of an extension boot on one leg offer an unusually distasteful cosmetic result, which identifies the wearer as crippled and deformed almost as far as she can be seen. Because the wearing of skirts does so little to minimize this unpleasant result, the need to consider the question of amputation with application of leg prosthesis is more urgent than in the boy patient. We cannot assume that all deformities in the female are to be overcome by amputation; the amputee when in swimming will still have to own up to his or her disability, but for the most part the choice between extension boots and external braces and a well contoured prosthesis would appear to be an easy one. The girl will not permit us to get away with crude or clumsy substitutions for her physical disabilities because her normal costume is revealing of such defects. It has been the habit of the prosthetist to furnish a limb to a child and to instruct the parents to bring the limb to him if anything goes awry with it. He is not aware that he would render the patient a very valuable service by instructing her in the use of rubber-base paint and encouraging her to keep the limb surface in constantly good repair. This can be done with a paint material that imitates the reflecting quality of the human skin and which may be altered to imitate any desired skin color. The orthopedist does not succeed in doing much better for the patient because so very often he will observe the walking gait and condition of the stump, and having decided that each is satisfactory, will permit the patient to go on her way with some grotesquely bad cosmetic set-up that could be much improved or made completely acceptable by some attention to clothing, contours and coloring. We now know that with a little help and some respect for her appearance we can enable the girl amputee to carry on quite successfully.

The suction socket limb has been in use for some years now and with considerable success. We think that it commends itself to the female fully as much or perhaps more than to the male because it enables her to be freed of any harness or belt for limb attachment which might be difficult to conceal in her normal clothing. The original concept of just what type of stump was best suited to the suction socket wearer has not undergone much change; however, the concept of what deviations from the ideal might still enable one to use the suction socket limb successfully has undergone a very appreciable change. Some individuals who look as if they were not very good candidates for this type of prosthesis may still be capable of wearing it successfully. The child is generally more adaptable than the adult and this factor works to our advantage. At one time we had regarded a little five year old girl in the Michigan program as being the youngest patient fitted with suction socket limbs bilaterally; we now find children at twenty months of age wearing the suction socket limb with success, so our concepts in regard to age are becoming very flexible. Technical details in regard to the amount of space distal to the stump in the socket, type of valve control employed and preference in materials we can leave to engineers and prosthetists. A suction socket can be made from plastic laminates that will be strong and well fitted. It is not clear at the present time whether the often used willow wood is a more desirable material for this type of socket construction or not. (Fig. 4.)

There are a few interesting problems related rather directly to the girl amputee that if worked out successfully would have an applica-

tion to any amputee individual. One of these arises through our experience with some bilateral amputees who although not completely helpless with their limbs off are nonetheless rather dependent. Suppose the leg amputee wants to go swimming; the single leg amputee can get out a crutch or crutches, and although this may be rather revealing, some type of wading becomes possible. With the bilateral amputee the situation is different, and here it would be a great advantage to the child or adult to have at least one limb that could be worn into the water. The solution should come through some combination of the Maehle limb, plastic materials, water-resistant foot construction, non-metallic ankle hinging and finally attachment by internal traction from the non-weight-bearing portion of the stump into the distal part of the prosthesis. Another problem that looms large for the female individual is the matter of better ankles that are less obviously jointed at the instep area. We are greatly interested in the possibility of developing a light, strong, plastic foot with or without a combination ankle mechanism for attachment to the shaft of the prosthesis.

The introduction of strong flexible materials such as nylon and vinyon and the development of rubber latex has placed in our hands materials that can possibly serve to cover the knee joint in either the BK or AK limb more successfully. Many prosthetists have been intrigued with the idea of taking a simple pylon, in which the below-knee portion of the limb consisted of a simple bar or narrow shaft, and covering it with a latex rubber contoured application which would be well shaped and resilient and would have considerable ability to imitate the skin and flesh of the living limb. No extensive development of such a device has occurred although limb makers continue to toy with the idea and some limbs have been fabricated on that basis.

Returning to the matter of special attachment and support for the prosthesis, there are possible combinations of thigh lacer and belt support used with children which offer the lateral stability at the knee afforded by the hinges and thigh lacer, and yet by adding in some vertical traction from a waist belt down to the prosthesis undoubtedly help in reducing any piston action in and out of a BK socket and make it less necessary to employ tight lacing in the thigh area. Desoutter's in England have used this device with bilateral BK amputee children.

FIG. 4. Rough appearance due to laminate material showing through the transparent plastic. (Motis-Campbell-Northrop limb, 1949.)

For the older child or adult some maternity garments have been developed in this country that take part of their support from the shoulders, which might make a better support than any garter belt. It seems possible that the postpartum version of this maternity girdle could be used without essential modification.

UPPER EXTREMITY PROSTHESIS

Restitution and complete rehabilitation are less satisfactorily attained in the hand and arm amputees generally, chiefly because of the complexity of the functions and performances that one calls upon the normal hand to perform, and because of the inability of the hand prosthesis to imitate all of those functions. There are outstanding reasons why the young child with an absence of one arm and hand does not immediately become a candidate for prosthesis: Overuse of the normal member permits a very satisfactory compensation for his defect all through infancy and earliest childhood, and the nature of his activities does not make any very pressing demand for the missing member until we create some special situation such as rowing a boat or playing a piano. One need not overlook the possibility that the parents may very greatly desire this child's rehabilitation to the fullest extent; but actually when one

studies the unilateral arm amputee at three years of age, one is impressed particularly with his ability rather than his disability. Restitution becomes a matter of concern for his appearance and not for restoration of function at that age. He will be found to function very effectively without prosthesis.

There is the possibility that a child at two or three years of age could and would use a hook device to commit mayhem on another child, and this may be a deterrent to early prosthesis on that basis. There is a tendency to think of this problem as being approached initially at about four and a half years of age. With a bilateral case, however, it may be that entirely different thinking would be applied and that very much earlier age groups might be fitted with a well chosen prosthesis. Conventional prosthesis has been based on wood, metal and harness for attachment and control that utilizes webbing, leather and cables. How early such a prosthesis has been used we do not know; the ability to coordinate the harness cables with shoulder motions necessary to activate the terminal device of the prosthesis may be present earlier than is generally supposed. Some children at three years of age have been fitted with a purely cosmetic arm and have generally made less use of it than they will make of the bare below-elbow stump, for the obvious reason that it is less readily manipulated and is devoid of tactile sensation. The last arm that we observed had been made in Chicago and was cosmetically pleasing in that the contour and coloring of the hand was acceptable in relation to the patient's normal member. Since this arm was devoid of joints at the wrist or elbow, it could be worn with sleeves of a little less than elbow length without attracting undue attention. It deprived the child of the use of his below-elbow segment and could not be justified except for its decorative value.

The University of California at its Los Angeles (Westwood) campus has fallen heir to the technics and to some of the personnel formerly employed by Northrop Aviation during the period prior to January, 1951, when Northrop was doing research in prosthesis. The program at the University is in the Engineering School and has been limited to arm prosthesis in adults, except for one or two children that have been accepted for consideration. This program has combined the talents of psychologists, engineers, orthopedic surgeons and prosthetists. They have accepted a number of very difficult arm problems for fitting with prostheses and it is reasonable to say that their experience with very short below-elbow stumps, and with disarticulation-type shoulder cases, has been considerable. They are working with plastic laminates exclusively, using casting technics for socket construction, and they have studied all types of controls and many types of terminal devices. Because the emphasis has been placed on light weight and good fitting, we would like very much to see this program extended to include children. The Michigan Commission's experience has led them to advise the use of a terminal device of the hook or clamp type for all the children they have fitted. This suggestion stems from the fact that such a device, although cosmetically bad, is fairly rugged and quite useful when properly employed. That they have gained acceptance for it even for their girls in high school suggests that they have a well coordinated program in building confidence of the patients and in securing their cooperation. The fact that cosmetic and hook type devices may be interchanged in the same prosthetic limb may simplify the problem of what the older child wears to go dancing.

Kineplastic prostheses, in which the terminal device is operated by a muscle or group of muscles isolated in the remaining portion of the stump on the affected side, is deserving of the attention it receives in properly selected cases but is as yet used infrequently in children. One will find in a recent publication by Spittler that a pectoral muscle has been used by kineplasty to activate the motor element in a little boy with an absence of the right upper extremity. Kessler reports 160 kineplasties performed upon children. One realizes that physiologically speaking kineplastic prosthesis means motivation of the device by ipsilateral nerve and muscle groups, in contrast to the situation in more conventional harness in which motion at the opposite shoulder carries the major burden in putting the prosthesis to use. Any female using an arm prosthesis will be committed to pretty long sleeves, and the kineplastic arm does not make this less necessary. It is possible that some older girls and women will give it favorable consideration because it minimizes the number of cable and webbing bands that will be required in the shoulder area.

We have several times discussed with an engineer prosthetist the possibility of using a magnetic terminal device to initiate a young child into the use of prostheses. Because the very young unilateral patient cannot be expected to see much need for a prosthesis, our thinking has been built around the concept of a bilateral case, with or without elbows, with the thought that some alnico seven or its counterpart could be inserted in the end of the prosthesis, in lieu of a hook, and the child taught to engage and disengage from a pencil, spoon, or toy in which magnetic properties would also have to be present. Children are not too clever about feeding themselves before two or three years of age but we are intrigued with the possibility of using this approach to a young bilateral patient experimentally.

Total absence of both upper extremities is a fairly uncommon physical catastrophe. We are acquainted with three girls and one boy who have complete absence of both arms, and a number of other children who exhibit very rudimentary upper arm development with very short humeral fragments present. The experience gained with disarticulation cases in World War II and in Korea has shown that prostheses can be fabricated for patients with one arm even though no proper stump is present, and that contrary to expectations some degree of prehension can be provided. This poses the very interesting question of the possible application of this type of device to the patient who has congenital arm amelia, and the possibility of something more than the mere cosmetic advantage. In the case of one eleven year old girl the question was answered by fitting her with two arms. Her mother has reported to us that "she can pick some things up with them," even during the first weeks of her experience with these limbs. It is encouraging to note that the arms please the child and her friends very much, even those who have been accustomed to her armlessness. Formerly physicians have said to the parents of such children that "nothing can be done." We do not believe that is correct although at present we consider this one of the least explored corners of a generally unexplored field.

One eminent psychologist, in discussing the failure of the amputee to adjust to the disability, made the point that in some instances the difficulty arose not because that person had become an amputee but because we were confronted with a generally unadjusted individual who could have been expected to react poorly to physical or psychic trauma and that the dismemberment is merely a trigger mechanism. He may be correct, and certainly our experience with children indicates that this is a field in which the armchair philosopher may be easily led astray. In instances in which extreme difficulty might be anticipated these difficulties do not always arise. An attractive junior high school girl became a double BK due to trauma. This child did not have a particularly easy time of it because she was quite ill from the accident; and since one stump had been denuded in a weight-bearing area, there was a long period of crutch walking before two prostheses could be used. Factors in her favor included intelligence, friends who never allowed her to drop out of activities and the reasonable assurance that she would someday walk and present a pleasing appearance. She was a good swimmer and still continued that activity and she has found that horseback riding is completely possible. We still think that a good-looking schoolgirl suddenly grotesquely maimed presents a very challenging problem and that she is fortunate indeed to escape with so little emotional disturbance.

The young congenital patients are very different; they do not know whether a little boy or girl is supposed to have one hand or two. It is the rest of us who have the task of bringing them to the realization that they are different in an important degree. Advocacy of early prosthesis is easily justified at the psychological level. The walking child is to all intents and purposes rehabilitated and proceeds to compete with other children successfully regardless of his basic condition. The fact that he exhibits startling defects in the privacy of his bathtub does not change this. He is a completely happy child if he can participate in the play of other active children.

Although not altogether a neglected field, the problem of attention to prosthesis in infancy and skillful attention to the cosmetic aspect of limbs for older children has not yet received the attention it deserves. While conceding the possibility of successful prosthesis in the very young employing conventional materials, we still insist that light weight, strength and perfect fitting are functions of the plastic laminates and are not at present equally readily attainable in the non-castable materials.

We presume that as funds become available for additional studies in this field very rewarding advances will be made.

REFERENCES

AYLESWORTH, R. Manual of Upper Extremity Prosthetics. Los Angeles, 1952. University of California (Los Angeles).

BARSKY, A. Congenital anomalies of the hand. *J. Bone & Joint Surg.*, 33A: 35, 1951.

BECHTOL, C. Suction socket; proper selection of patients for above knee artificial leg. *J. A. M. A.*, 146: 625, 1951.

BRYANT, C. Crippled children enjoy aquatics. *Crippled Child Magazine*, October, 1948.

CANTY, T. New cineplastic prosthesis. *J. Bone & Joint Surg.*, 33A: 612-617, 1951.

CANTY, T. Suction socket for above knee prosthesis. *Nav. M. Bull.*, 49: 216-233, 1949.

CARNAHAN, J. Back in the swim. *Crippled Child Magazine*, October, 1948.

CHITTENDEN, R., MOTIS, G. and SPIERS, D. Prosthetics for the young child. *Crippled Child Magazine*, 30: 14, 15, 29, 1951.

KELIKIAN, H. and BINTCLIFFE, E. Functional restoration of the thumb. *Surg., Gynec. & Obst.*, 83: 807–814, 1946.

KESSLER, H. Amputations of the upper extremity. *M. World*, 60: 1942.

KESSLER, H. Cineplastic amputation. *South. Surgeon*, 7: 285, 1938.

KESSLER, H. Rehabilitation of the arm amputee. *Plast. & Reconstruct. Surg.*, 2: 1, 1947.

KESSLER, H. Rehabilitation of the amputee for gainful livelihood. *S. Clin. North America*, 25: 382, 1945.

LEE, J. Educating crippled children (series of articles). *Crippled Child Magazine*, December, 1942; April and October, 1943.

LESSER, A. Emotional problems associated with handicapping conditions in children. Children's Bureau, publ. no. 36, 1952.

MCMASTER, P. and MAZET, R. Suction socket for above knee amputation. *Surg., Gynec. & Obst.*, 89: 335–338, 1949.

Michigan Crippled Children's Commission. Back in the play with prosthetics. *Crippled Child Magazine*, 1948.

MOTIS, G. Artificial arm and leg research and development. (Final Report on, from Northrop Aircraft.) Surgeon General and Veterans Administration, 1951.

SLOCUM, D. Atlas of Amputations. St. Louis, 1949. C. V. Mosby Co.

SPITTLER, A. Cineplastic muscle motors for prostheses of arm amputees. *J. Bone & Joint Surg.*, 33A: 601-612, 1951.

WEAVER, H. and YOUNG, J. Summary report of the Sarah Mellon Scaife Foundation. Fellowship No. 332-3-4 to August 1, 1951. Mellon Institute of Industrial Research.

RECONSTRUCTION PROCEDURES FOR FOREARM BONE DEFECTS*

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NOTHING can replace the function of the human hand. Even partial preservation of forearm and hand tissue is usually preferable in appearance and usefulness to the most highly developed and specialized prosthetic appliance. It is a cardinal principle of traumatic surgery that extreme conservatism must be practiced in the management of hand and forearm wounds in order to retain as much viable tissue as possible for future rehabilitation. The temptation to perform early amputation must be resisted even in view of extensive tissue destruction. Débridement should include only obviously necrotic material and should be followed with early wound closure or skin coverage.

This attitude of conservatism applies to war wounds as well as to industrial or other civilian injuries. In battle casualties there are additional factors such as the questionable availability of immediate specialized attention, the problem of management during transportation and the ever present danger of anaerobic or other serious wound infection. In the Korean conflict methods of emergency care, prompt evacuation by air and the use of blood and antibiotics have greatly reduced the special hazards incident to battle wounds. The present outlook in these cases is probably very similar to that associated with the more severe types of civilian injuries to the forearm and hand.

In battle injuries to the extremities there is perhaps one distinctive feature which makes the prospect for functional recovery somewhat less favorable. The soft tissue damage in both military and civilian types of trauma may be equally severe and the chances for recovery equally good or bad depending on the amount of tissue destroyed. In the case of the battle casualty, however, there is often an extensive loss of bone structure because of the velocity and explosive nature of the injuring missile. Further removal of bone may be indicated, in spite of due respect for tissue preservation, at the time of wound débridement. Even with prompt and adequate surgical management wound infection may be a complicating factor and this may necessitate subsequently a more extensive excision of infected bone in order to produce wound healing. The end result in many battle injuries is an extremity which lacks an important area of bony structure and therefore presents a challenge to the skill and ingenuity of those who assume the problems of reconstructive surgery. (Fig. 1.)

The material in this study represents a review of some of the methods of approach in dealing with the loss of bone structure in the forearm. In every instance of such bone loss there is associated soft tissue damage which may be in itself even more disabling from the functional point of view. The reconstruction of such an injured forearm must be accomplished by close cooperation between the orthopedic surgeon, the plastic surgeon, the neurosurgeon and the physiatrist. Prompt and thorough wound débridement must be followed with early closure or suitable skin coverage. Immobilization must be as brief as possible with early functional use of the part. Nerve repair when indicated should be performed at an early date and should not be postponed until the bone condition has become stabilized. Replacement of scar tissue or temporary skin coverage with full-thickness skin is imperative when bone reconstructive procedures are contemplated. Wounds must be completely healed before bone surgery is considered; and when this involves a previously infected wound, a minimal interval of six months should have elapsed from the time of healing before such surgery is performed.

Bone reconstruction should be considered principally for restoration of function. If some associated nerve or muscle injury makes function impossible it is useless to restore bone continuity. If, however, the patient's disability is due at least in part to pain and instability

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FIG. 1. Severe gunshot wound of forearm. A, photograph on arrival at Army general hospital six weeks following injury; B, photograph following split-thickness skin coverage and replacement with pedicle graft; C, original roentgenograms on admission; D, roentgenograms following multiple bone-grafting procedures with eventual non-union of radius and utilization of ulna as single forearm bone.*

associated with the loss of bone structure or to weakness because of relative muscle lengthening, reconstructive bone surgery may offer hope for improvement in function. It is this type of problem which is considered in this article. There is no attempt to correlate the functional loss due to associated soft tissue injuries. These were present in all our cases and were dealt with as indicated. Our immediate concern was the improvement in function which might be obtained by operative measures to restore the loss in bone continuity of the forearm.

In the past three years in an Army general hospital we have observed a group of about twenty-five patients with severe forearm injuries associated with loss of bone structure. Most of these have been in Korean casualties but a few represented severe civilian injuries with functional impairment due in part to loss of bone continuity. Each patient was considered as an individual problem and the treatment recommended was that which seemed

* Figures 1 to 3 were made by the Letterman Army Hospital Photographic Laboratory.

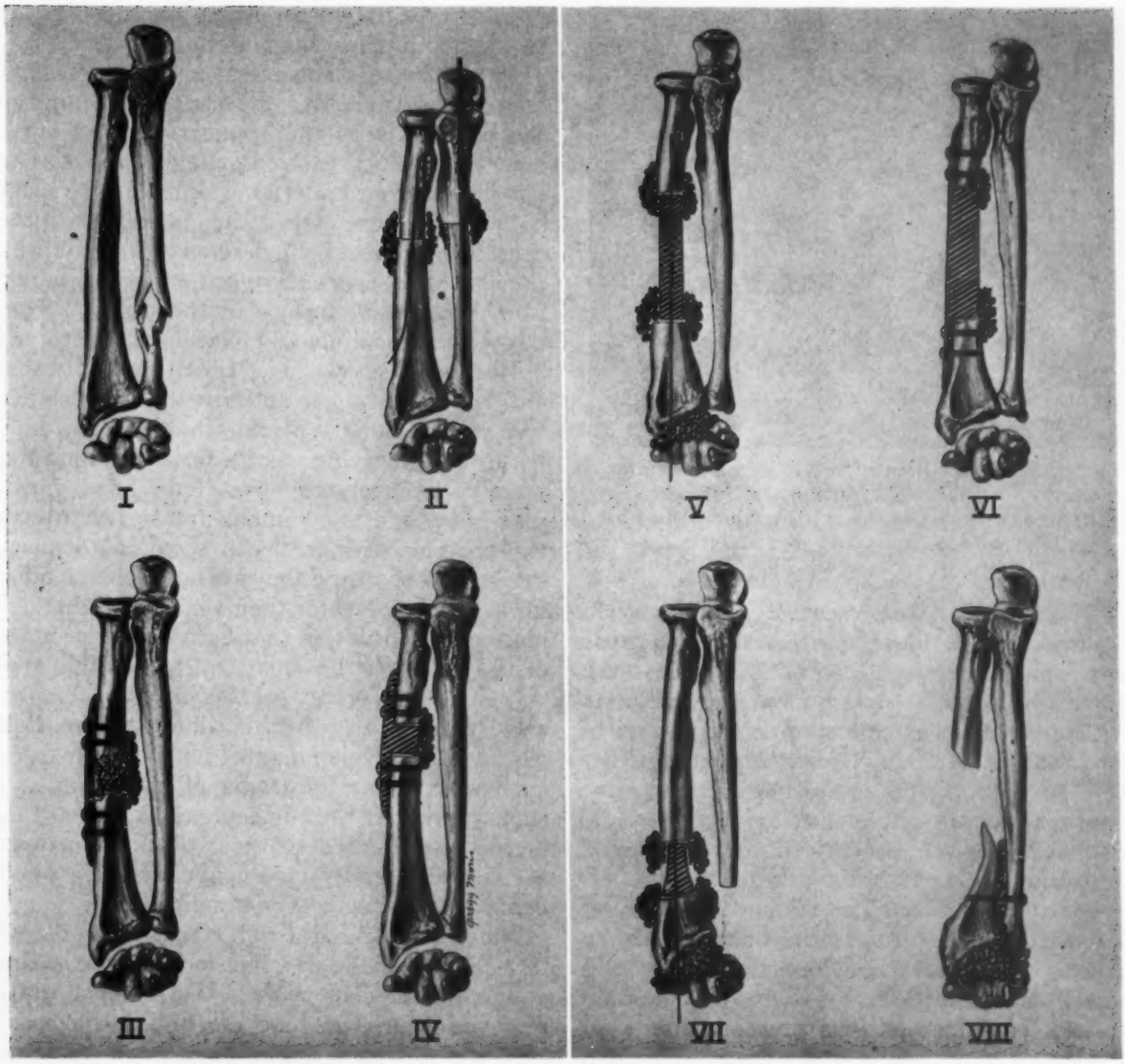

FIG. 2. Methods of forearm bone replacement. I, No operation; II, forearm shortening and cancellous bone chips; III, onlay graft; IV, iliac block or key graft; V, iliac bone replacement; VI, fibular graft; VII, ulnar graft; VIII, construction of single forearm bone.

appropriate to the special requirements. In all cases treatment of soft tissues, control of infection, nerve surgery, proper skin coverage and conservative attempts to regain function by physical therapy were given priority to bone reconstructive procedures.

METHODS OF RECONSTRUCTION

In the patients who have come under our supervision there were eight principal methods of approach in the orthopedic reconstructive management. These will be outlined and the important considerations discussed. All of them have been previously used and reported by other observers and no one method is considered to be superior to others in the management of problems associated with loss of forearm bone structure.

No Operative Treatment. There are some patients in whom loss of forearm bone structure presents no significant discomfort or functional impairment. This situation may occur principally with loss of bone in the lower third of the ulna or the upper third of the radius. Elbow and wrist function may be quite satisfactory and stability may be excellent when there is bone loss in either of these areas. (Fig. 2, No. 1.) Even with more extensive destruction of an important stabilizing bone of the forearm, such as the upper end of the ulna, surprising function

FIG. 3. Roentgenogram of severe gunshot wound of the elbow with partial loss and non-union of the upper portion of the ulna. There was limited but satisfactory range of elbow movement and good stability.

and stability may be present. (Fig. 3.) In such a situation it is obviously unnecessary to institute any form of bone replacement and such surgery especially through an area of previous trauma with or without infection is nothing short of meddlesome. We have had three such patients and have found no indication for operative intervention. In spite of the loss of bone there was nothing to be gained by attempted replacement.

Bone Shortening. The simplest method of reconstruction with forearm bone loss is to shorten the forearm and re-enforce the freshened fracture surfaces by means of iliac chip grafts. This method has the advantage of avoiding a gap of bone which must be bridged by bone graft material and theoretically at least should give the highest incidence of successful results. However, there are limitations to the method which must be considered. Undue shortening of bone is not consistent with good function because of the relative muscle lengthening. It is difficult to place an exact limit on forearm bone shortening consistent with satisfactory muscle function because of individual variation. Certainly bone shortening of more than 2 inches should be open to considerable question as to subsequent function. However, we have one patient with a shortening of 4 inches whose hand function has a considerable degree of usefulness. (Fig. 1.) This method is appropriate principally when both bones show similar loss so that no great operative sacrifice of length is required (Fig. 2, No. II), or in patients in whom the construction of a single forearm bone is contemplated.

Onlay Grafts. The defect in a forearm bone may be bridged after the usual freshening of the bone ends by the application of an onlay bone graft which is strong enough to act as an internal fixation material. The remaining space between the bone ends is then filled in with the cancellous type of bone derived ordinarily from the iliac crest. The onlay graft may be obtained from the medial surface of the tibia or from the crest of the ilium and fixation is maintained by means of screws. The tibial grafts (Fig. 2, No. III) are stronger and give better stability and fixation but the iliac grafts have the added feature of supplying a large mass of porous and readily incorporated cancellous bone. Such iliac onlay grafts are more apt to fracture in the postoperative weeks in spite of adequate external fixation and they are not recommended for any defect greater than 1 inch. It is furthermore our observation that because of the curve of the iliac crest an onlay graft from this area will give considerably greater bulk to the operative area with possible difficulty in skin closure, the development of wound necrosis or even subsequent limitation of pronation and supination. If the defects chosen for this method are limited to those of 1 inch or less, the iliac onlay graft has a field of usefulness and definite advantages over tibial grafts.

Iliac Block or Key Graft. Where the defect in a forearm bone is 1 inch or less, the entire gap can be filled with a key-shaped graft removed from the iliac crest. The block of cortical and cancellous iliac bone remains attached to a cortical flange on each end and the flanges are fastened to the freshened forearm bone ends by means of screws. (Fig. 2, No. IV.) This method affords good fixation and a large bulk of cancellous grafting material for rapid incorporation. However, it cannot be used in large gaps and the danger of fracture of the graft is greater than with strictly cortical types of bone grafts. It has the advantage of supplying a single block of principally cancellous bone material to replace the entire defect.

Iliac Bone Replacement. When the defect is greater than 1 inch, an appropriate strip of iliac bone exclusive of the curved crest may be fashioned in sufficient length to fill the gap completely. Such bone will have two thin cortical surfaces instead of the three surfaces

present with the iliac key type of graft. However, the bulk is usually adequate for forearm bone replacement. If it does not seem adequate, the main block of iliac bone can be re-enforced with surrounding iliac chips. In one of our cases in which this was not done, a subsequent re-enforcing procedure brought eventual bone healing after fracture of the graft. Such large iliac bone blocks are held in position by means of some type of intramedullary wire or pin. (Fig. 2, No. v.) Wrist arthrodesis was performed in the illustrated case because of associated radial nerve injury.

Fibular Bone Graft. In large forearm defects a portion of the shaft of the fibula offers an ideal solution from the viewpoint of restoration of length. However, the fibula is largely cortical in consistency except at the upper and lower ends so that the available shaft portion does not offer a preferred type of bone-grafting material. Such a graft is slowly vascularized and incorporated. It is subject to late refracture due to poor vascularity although in the early stages it gives good internal fixation either by means of flanges on each end with screw fixation or by intramedullary pin. (Fig. 2, No. vi.) It has also been our impression that in an area which is the site of an old wound, however well healed, the fibular type of graft is more likely to be associated with wound necrosis or frank infection.

Ulnar Bone Graft. When there is a defect in the radius over a considerable period of time, radial deviation of the hand usually occurs with prominence of the lower end of the ulna. At the time of repair of the radial defect the lower end of the ulna is usually excised to correct the deformity and to improve wrist motion. Such a section of ulna may be used as a graft to bridge the radial defect, the fixation being obtained by intramedullary wire or pin. In this group one such ulnar graft to the radius was successfully associated with an arthrodesis of the wrist joint (Fig. 2, No. vii) but the latter procedure will only be indicated under special conditions.

Construction of a Single Forearm Bone. Although it is always preferable to preserve the continuity of both forearm bones because of strength, stability and retention of wrist pronation and supination, there are circumstances where some sacrifice must be made. When the loss of bone structure of either radius or ulna is too great for practical consideration of replacement, the unaffected bone may be used alone for stability and function. Another consideration for the adoption of a single forearm bone as the functioning mechanism is persistent infection which has caused previous failures in attempted bone grafting. It is well recognized that each additional effort to apply bone grafts of any type to a previously infected area will have progressively less prospect of success. It may therefore be considered advisable for subsequent operative efforts to avoid the actual area of previous infection and to utilize the single bone forearm mechanism as the more practical solution to functional recovery.

We have had five patients in whom construction of a single forearm bone was considered the most suitable method of approach. In all of them the continuity of the ulna was maintained and this bone was united at its lower end to the distal radial fragment and to the carpal bones. (Fig. 2, No. viii.) In all of these patients there was previously either very little or no remaining wrist movement so that arthrodesis of the wrist in the position of election resulted in functional improvement rather than functional loss. The amount of fixed supination desired by the patient was arranged prior to operation. It is conceivable that in certain patients with this type of procedure the lower ulna could be implanted into the lower radial fragment with subsequent loss of pronation and supination but no impairment of any other useful wrist function which existed prior to operation.

Where the bulk of the radius is intact and the upper ulna has been lost, a fairly stabile and useful forearm may result. (Fig. 3.) Cross union between an upper fragment of the ulna and a lower radial fragment may be effected with good stability and practical conservation of elbow and of wrist movements other than pronation and supination. Such variations of the single forearm bone principle may be utilized in the restoration of painless hand and forearm function with the sacrifice of such strength and joint mobility as may be required.

It must be emphasized that these procedures of bone reconstruction are performed only in view of the possibility of functional recovery. If return of function is an impossibility because of associated nerve, muscle, tendon or joint injuries, bone restoration will be unnecessary and futile. Any degree of useful functional

recovery in a forearm and hand will, however, be preferable to amputation and we reserve the latter procedure for situations which present no prospect for usefulness. This position is maintained very often in spite of the protests of patients who request amputation even in the presence of some degree of painless function.

SUMMARY

1. Every effort must be made to preserve even limited function in forearm injuries with loss of bone. Amputation must be reserved for injuries presenting no prospect for useful functional recovery.

2. Close cooperation between the orthopedic surgeon, the neurosurgeon, the plastic surgeon and the physiatrist is essential in the treatment of such injuries.

3. Some of the methods in current use for the restoration of forearm bone loss are reviewed. The method of reconstruction which is selected should be based on existing individual requirements.

REFERENCES

1. American Academy of Orthopedic Surgeons, Lectures on Reconstruction Surgery of the Extremities: from the 1944 Instructional Courses. Ann Arbor, 1946. Edwards Bros., Inc.
2. Boyd, H. B. The treatment of difficult and unusual non-unions, with special reference to the bridging of defects, *J. Bone & Joint Surg.*, 25: 535–552, 1943.
3. Horwitz, T. and Lambert, R. G. Massive iliac bone grafts in the treatment of ununited fractures and large defects of long bones; the combined bone graft—metallic plate technique. *Surg., Gynec. & Obst.*, 84: 435–450, 1947.
4. Lipscomb, P. R. and Ivins, J. C. Repair of defects of the shafts of long bones. *S. Clin. North America*, 29: 1153–1168, 1949.
5. Miller, R. C. and Phalen, G. S. The repair of defects of the radius with fibular bone grafts. *J. Bone & Joint Surg.*, 29: 629–636, 1947.
6. Moore, J. R. Massive bone defects in compound wounds. *J. Internat. Coll. Surgeons*, 10: 274–286, 1947.
7. Scuderi, C. Restoration of long bone defects with massive bone grafts. *J. A. M. A.*, 137: 1116–1121, 1948.
8. Snedecor, S. T. and Coffey, F. L. Bone grafts in non-union of war fractures. *Am. J. Surg.*, 71: 577–586, 1946.

THE TREATMENT OF RUPTURED LUMBAR INTERVERTEBRAL DISCS

CRITERIA FOR SPINAL FUSION

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THE treatment of ruptured lumbar intervertebral discs is probably one of the most controversial subjects in the field of surgery today. There are almost as many opinions as to what and how an individual patient should be treated as there are patients. For the first five years or so after Mixter and Barr[1] put the syndrome of the ruptured lumbar disc on a firm foundation the surgical treatment as well as the indications for treatment was quite uniform. In the early articles by Love and Walsh,[2] Spurling[3] and Dandy[4] very precise dogmatic criteria were laid down. Dandy went so far as to say that no diagnostic procedures were required to determine the presence of a ruptured disc, that the patient's history alone was all that was needed to recommend surgical treatment. If the patient had a history of intermittent low back pain accompanied by sciatica, he was a candidate for a disc operation. The operation described by Love[5] consisted of a unilateral intralaminar removal of the small fragment of herniated disc which was encroaching upon and compressing the spinal nerve root.

It became apparent, however, within a very short period of time that these dogmatic criteria and particularly the stereotype operation was not the answer to curing patients with the disc syndrome. A continuation of the low back pain following removal of the herniated disc or recurrence of the sciatica within weeks or months after the operation was the frequent experience of every neurosurgeon treating ruptured discs. It was because of the failure of this operative procedure to cure completely and permanently every patient of his back symptoms that the disc cases came into the hands of the orthopedic surgeons. When the simple disc operation failed to relieve the back pain, the neurosurgeon usually escaped the responsibility of further treatment by declaring the patient "an orthopedic case."[6]

The orthopedic surgeons resorted to the operation of spinal fusion either with or without removal of the protruded disc in an effort to cure what they considered an unstable lumbar spine.

In the past ten years most orthopedic surgeons have favored the combined procedure, that is, spinal fusion operation after removal of the protruded intervertebral disc. Ghormley and associates[7] in 1942 advised spinal fusion in disc cases if the sciatic pain was associated with lumbosacral arthritis, spondylolisthesis, spondylolysis or a combination of these. Smith, Deery and Hagman[8] in 1944 extended these to include "an unstable joint with or without back symptoms as determined by x-ray." Barr[9] stated in 1947, "It appears probable that the trend is toward fusion of the spine, at the time of laminectomy, in an increasing number of these cases. The thesis that every patient should have a spine fusion done at the time of laminectomy is tenable."

The neurosurgeons, on the other hand, have consistently adhered to the belief that spinal fusion is not necessary in most cases. They have based their conclusions on the percentage of good or satisfactory results obtained by simple disc removal in large series of cases. Dr. Walter Dandy[10] started this by stating very dogmatically that "spinal fusions in disc cases are absolutely unnecessary; that all one has to do is curette out the nucleus pulposus and the joint will fuse itself." This, of course, is not altogether true. Poppen,[11] Spurling and Grantham,[12] Lenhard,[13] Raaf and Berglund,[14] Caldwell and Sheppard,[15] Shinners and Hamby[16] and others have reported from 40 to 82 per cent of patients relieved of back pain and sciatica by laminectomy without spinal fusion. Comparison of groups of cases with and without spinal fusion published by Barr,[9] Ghormley, Love and Young,[7] and Smith, Derry and Hagman[8] disclose a higher percentage of good results from the combined

procedure. These figures are based on questionnaires and follow-up examinations on patients. Reports from an insurance company by Marble and Bishop[17] indicate, however, that the combined operation gave good results in only 14 to 40 per cent of cases.

There are favorable arguments by the neurosurgeons in favor of laminectomy and simple disc removal alone. Love[18] has reported a recurrence rate as low as 5 per cent in a series of 987 patients traced by questionnaire. Caldwell and Sheppard[15] reporting Eccles' cases showed 8 per cent recurrences. Those who favor the combined procedure may have a higher percentage of cures, but it must be remembered that the percentage of failures in spinal fusion operations is even higher. Bosworth[19] has given figures from 15 to 25 per cent of pseudoarthrosis following spinal fusion. The highest incidence of failure of fusion occurs at the L4-5 level (where the largest number of ruptured discs are found). Love has also reported that protrusion of the nucleus pulposus has recurred in two of his patients who underwent spinal fusion and the fusions shown by x-ray had been successful. I have had a similar experience. There have been many reports also of disc ruptures above the spinal fusion occurring at a later period. If a disc protrusion can recur after a spinal fusion and pseudoarthrosis occur in much higher percentages than recurrence of disc protrusions, one can see why the neurosurgeons continue to believe that fusion is unnecessary.

Frieberg and Hirsch[20] in 1946 and O'Connell[21] more recently (1950) have stated that "to get rid of the severe sciatic pain is the patient's greatest wish, it should be done as quickly and simply as possible. Spinal fusion is considered an unnecessarily great operation with considerably longer post operative treatment and convalescence, and in the end with no greater chances of complete cure. The stabilizing operations should be reserved only for those disc cases who are invalided by low back pain."

The battle of words between neurosurgeons and orthopedic surgeons goes on.[22] The problem involved is whether or not to employ fusion. This paper is presented to report my experiences in the surgical treatment of ruptured disc with the hope that they may help to settle this controversial question. Caldwell and Sheppard[15] (1948) stated boldly, "There are no criteria for spinal fusion following removal of protruded nucleus pulposus." Experience with different methods of surgical treatment and new diagnostic procedures which have been developed since that time may change this dogmatic conclusion considerably.

As stated previously the great majority of neurosurgeons are of the opinion that spinal fusion operations for ruptured lumbar intervertebral discs are seldom if ever necessary. As a neurosurgeon I probably stand alone in the belief that a spinal fusion should be done on every proven ruptured lumbar disc. In 1944 after the appearance of the report by Shinners and Hamby[23] the cases of disc patients I had operated upon over the preceding five-year period were reviewed. Being isolated on a small island during wartime, I practically had to live with my patients. I was impressed by the number of them who had returned after the operation continuing to complain of low back pain or a return of the sciatica. I was the only neurosurgeon in the Hawaiian Islands and the patients having no place else to go would camp on my doorstep if they were not completely cured of their symptoms. It became apparent that the simple operation in which only the herniated fragment of disc was removed was not the answer to the disc problem. I, therefore, devised a procedure, which I hoped, based on the physiology of the disc, would restore to normal the function of the patient's spine and prevent further occurrences of disabling pain. This operation, consisted of fusion of the bodies of the vertebra after complete removal of the ruptured disc. Large full thickness bone grafts obtained from the crest of the ilium were used. The purpose of this procedure was to maintain the normal width of the intervertebral space and the intervertebral foramen. At the same time all false movement between the vertebra resulting from injury and collapse of the intervertebral disc was arrested. Since the primary function of the intervertebral disc is to act as a non-compressible expansible support to hold the two vertebra apart, it was believed that the surgical treatment of a ruptured and collapsed disc should be directed toward restoring, if possible, these normal intervertebral relations.

In the eight years that have passed since this operation was first devised it has been per-

formed on practically every disc patient I have operated upon. A series of over 300 vertebral body fusions have now been done. I have followed up these cases from six months to eight years postoperatively. They were recently reviewed in preparation for a scientific exhibit at the American Medical Association in Atlantic City, June 11, 1951.[24] I am singularly fortunate in having most of my patients situated on a small island which is condusive to an excellent follow-up study of surgical cases. These patients were re-examined and x-rayed. A comprehensive statistical study of the results is the subject of another communication.[25] Suffice to say, however, that over 85 per cent of these patients consider themselves (and were considered by the examiner and the patient's employer) to be cured completely of their disc syndrome without residual or disability. The excellent results obtained by this operation have convinced me that my original contention was correct, namely, that all patients with a proven ruptured intervertebral disc should be subjected to a spinal fusion, provided the fusion is of the vertebral body type.

There is still very sound argument, however, on both sides of the fusion question. My neurosurgical colleagues have quoted me statistics of hundreds of patients upon whom simple disc operations were performed who considered themselves completely relieved of their disc symptoms. These doctors maintained that many of their patients are and have remained symptom-free for years after operation, and are considered by both the doctor and the patient to be cured completely. Unfortunately, however, this does not occur in every case. It is statements of this kind, therefore, that continue the argument of whether or not to use fusion.

Up until recently surgeons have had no positive diagnostic criteria to determine which patient will be completely relieved of his disc syndrome after a simple disc removal and which patient will continue to have incapacitating back pain or recurrence of the sciatica within a few months. It is for this reason that I have performed fusion operations in all disc cases. Most neurosurgeons however recommend, as Spurling does, that patients should first be given a conservative course of therapy in the form of two weeks' bedrest before he is considered a candidate for surgery. If he obtains no relief from disc symptoms or has recurrent episodes, then a disc operation is considered. Spurling[6] states that "no patient should be subjected to an operation for a lumbar disc without presence of unilateral or bilateral sciatic pain which is refractory to conservative treatment; that low back pain alone is seldom, if ever, an indication for an intervertebral disc operation." If the patient has incapacitating low back pain, he is "strictly an orthopedic problem," to be treated conservatively with braces or surgically by spinal fusion. He maintains, however, that these patients are rare.

FIG. 1. Changes in vertebrae associated with a ruptured intervertebral disc. Note L3-4 narrow interspace and spur formation.

It has been my honest belief and teaching for many years that once an intervertebral disc has been ruptured it is impossible for nature to reconstruct to normal the anatomic integrity of the disc. An injury to the disc usually results in a tear of the fibers of the annulus fibrosus. With a break in the fibers which surround the nucleus pulposus this gelatinous liquid-like, non-compressible substance is permitted to escape into the torn

fibers of the annulus. The nucleus then loses its spherical shape.[26] If the non-compressible support between the vertebral bodies is lost, the disc becomes a mere "washer" which collapses with weight bearing much the same as an automobile sitting on a flat tire. An abnormal joint in the spine results. With closer apposition of the vertebral bodies and articular facets certain pathologic changes take place in these structures due to constant irritation from the trauma of weight bearing.[27]

I have also maintained, and have a long series of x-rays to verify it, that the changes in the vertebra secondary to a collapse of an intervertebral disc will occur in every patient who has suffered a ruptured disc if he is followed over a long period of time. These changes in the vertebra are: osteophyte formation, narrowing of the intervertebral space and the intervertebral foramen, subarticular sclerosis of the vertebral bodies, and malalignment of the spine. (Fig. 1.) The argument is that these changes in the vertebra may be present without symptoms. Caldwell and Sheppard[15] found these abnormalities in nearly 70 per cent of patients studied, but were unable to correlate the functional end result with the presence of these changes. However, their existence is indicative of a pathologic process which may at any time give symptoms, and in the disc cases we are interested primarily in treating symptoms. To quote Spurling[6] again, "the presence of arthritic spurs on the body of the vertebra are nature's attempt to fuse the vertebra. These may be an indication for the need of a spinal fusion if the patient has symptoms of incapacitating low back pain." Since many patients with no back pain may show these changes in the x-ray they cannot be considered as positive criteria to answer the question of whether or not to fuse; but when symptoms of low back pain are coincident with these structural changes in the spine, representing a loss of an intervertebral disc, they are used by me as positive indications for a fusion of the vertebral body type.[28]

I have been extremely interested in and am greatly indebted to Dr. K. Lindbloom for introducing the new diagnostic procedure which he calls the "discogram."[29,30] We have used this procedure since November, 1950, and are of the opinion that it is one of the most important contributions to the disc problem of the present day. Neurosurgeons have been very reluctant to advise surgical treatment for ruptured disc without positive objective evidence. Herniation of the disc into the spinal canal must be shown either clinically or fluroscopically by the presence of sciatic pain or a positive defect in the myelogram. Low back pain without sciatica is considered by most neurosurgeons as not being due to intervertebral disc disorder and disc operations for this condition, heretofore, have not been recommended (Spurling). However, it has been the experience of every neurosurgeon to see patients who have complained of having had intermittent attacks of low back pain over a period of years, finally develop the telltale sciatica. In reviewing such a patient's history one would be forced to conclude that the patient probably had a ruptured disc all the time, to account for his back pain. The disc, however, had not herniated into the spinal canal to give objective evidence of nerve root pressure, so a positive diagnosis of a ruptured disc could not be made. Surgery could not be recommended without these objective criteria. The discogram procedure has added considerable light to the pathology of the ruptured disc in the absence of objective signs.[31] We are able to determine with this procedure whether or not the patient, who has no objective signs whatsoever on examination, but who has a story of intermittent, severe, incapacitating low back pain should be treated surgically, or whether he has some other condition.

The discogram is performed by a direct puncture of the intervertebral disc through the spinal canal and injection of a radiopaque water soluable dye (diodrast). In the normal intact disc less than ½ cc. of dye can be forced into the intervertebral space and the dye is confined to the region of the nucleus pulposus. If the annulus, however, has been ruptured and the disc has collapsed, 3 cc. or more of the dye can easily be injected into the interspace and the disrupted disc demonstrated by x-ray, even though no part of the disc has herniated into the spinal canal. (Fig. 2.)

We have been able with this procedure, therefore, to recognize the presence of a ruptured disc as the pathologic etiology of low back pain in the absence of objective signs and treat the patient surgically long before sciatica develops and thus prevent months or

years of intermittent low back pain with loss of time and money.

In studying a series of patients upon whom the discogram procedure had been done, it occurred to me that this procedure may be used to settle the fusion question. We might be able by this diagnostic test to verify the thesis that "once a ruptured disc always a ruptured disc," and thereby arrive at some definite criteria for spinal fusion. The discogram examinations could be done on patients who had had a "simple" disc operation months or years before, to determine the pathologic state of the interior of the intervertebral disc. Obviously if the patient has roentgenologic signs of productive changes about the adjacent vertebral bodies, such a procedure would be unnecessary for these changes result from a collapsed disc.[27] (Fig. 1.) However, some patients may be found who have gone for years after their herniated disc has been removed and have remained symptom-free. The x-ray in these cases may show no productive changes about the vertebra or narrowing of the intervertebral space. One could determine by the discogram whether or not the confines of the nucleus pulposus had originally been ruptured or not. If one should find what appears to be a normal discogram in old disc patients who had been previously operated upon and a proven herniated disc removed, we may have the answer as to which patient should require fusion and which should not. It is possible, but not probable, that a patient may tear a fragment of the annulus fibrosus in the peripheral part of the disc with subsequent herniation and nerve root pressure without rupturing the central fibers of the annulus. If the immediate confines of the nucleus pulposus could be shown by a discogram preoperatively to be intact and therefore the supporting mechanism of the intervertebral space preserved, such a patient would not require a spinal fusion. If the diagnostic workup of the patient who shows a classic clinical picture of a herniated disc with nerve root pressure and evidence of encroachment of the disc on the spinal canal (verified by myelography), but with what appears to be a normal discogram at the same level, this patient would theoretically be considered a candidate for a simple disc operation only. X-ray examinations would indicate the presence of an intact nucleus pulposus and therefore a normal intervertebral joint. It is my opinion, however, that very few if any cases with these findings will be found.

FIG. 2. Ruptured intervertebral disc L3-4, with anterior herniation as demonstrated by discogram. Compare with normal disc L4-5.

If on the other hand, the discogram demonstrated an internal rupture of the disc with disorganization and collapse of the nucleus pulposus with or without herniation into the spinal canal, this patient has a better than two-to-one chance of having continued disability from intermittent attacks of low back pain if only a simple removal of the disc is done. He should, therefore, be considered as a candidate for a spinal fusion operation from the beginning. The operation which has given the best results in my hands is one in which the entire pathologic disc is removed and replaced by intervertebral bone grafts. (Fig. 3.) This procedure which re-establishes and maintains normal anatomic relationship between the two vertebral bodies insures against postoperative backache, prevents recurrence of further disc protrusion and obviates the necessity of a second operation.

If interest could be aroused among neuro-

FIG. 3. Postoperative x-ray after complete removal of intervertebral disc and insertion of large bone grafts in intervertebral space. Note normal width of interspace.

surgeons to perform postoperative discograms on a series of patients who have been operated upon and presumably cured of their disc syndrome months to years after the operation and if significant number of cases could be accumulated, the information gained therefrom would furnish for future generations the answer to the problem of whether or not to employ fusion. If such an experiment should be carried out, it is my prediction that in every instance the patients would be found to have a torn pathologic disc. If so, then the statement "once a ruptured disc, always a ruptured disc," would be tenable. Although some of these patients may so stabilize their pathologic joint to remain asymptomatic for a long time, a very large number of them will continue with disabling symptoms. Since it is impossible to judge prior to any disc operation which group a given patient will end up in, it has been my practice to treat all patients alike, namely, by removal of the disc and fusion of the vertebral bodies.

The operation of vertebral body fusion which I have perfected and performed since 1944 is now completed in two hours or less, the patient is confined to bed for only one week or less and is almost always able to leave the hospital on or about the tenth postoperative day. No supports or back braces are needed or worn. Most patients are able to return to their jobs within three to four weeks after the operation. X-rays have shown the bone grafts to be solidly fused as early as two to three months. These postoperative recovery rates compare favorably, if not better than those of the "simple" disc operation. The end results of the vertebral body fusion are so far superior to those which I obtained when I did the simple disc removal, I am forced to conclude (with Barr) that "the thesis that every patient should have a spinal fusion at the time of laminectomy is tenable."

REFERENCES

1. MIXTER, M. J. and BARR, J. S. Rupture of the intervertebral disc with involvement of the spinal canal. *New England J. M.*, 211: 210, 1934.
2. LOVE, J. G. and WALSH, M. N. Protruded intervertebral disks. *Surg., Gynec. & Obst.*, 77: 497, 1943.
3. SPURLING, R. G., MAYFIELD, F. H. and ROGERS, J. B. Hypertrophy of the ligamenta flava as a cause of low back pain. *J. A. M. A.*, 109: 928–932, 1937.
4. DANDY, W. E. Newer aspects of ruptured intervertebral discs. *Ann. Surg.*, 119: 481–484, 1944.
5. LOVE, J. G. Special nerve root retractor used in removing protruded intervertebral disks. *Proc. Staff Meet., Mayo Clin.*, 12: 393–394, 1937.
6. SPURLING, R. G. and GRANTHAM, E. G. Ruptured intervertebral disc in the lumbar region. *Am. J. Surg.*, 75: 140, 1948.
7. GHORMLEY, R. K., LOVE, J. G. and YOUNG, H. H. The "combined operation" in low back and sciatic pain. *J. A. M. A.*, 120: 1171–1176, 1942.
8. SMITH, A. DEF., DERRY, E. M. and HAGMAN, G. L. Herniation of the nucleus pulposus. A study of one hundred cases treated by operation. *J. Bone & Joint Surg.*, 26: 821–826, 1944.
9. BARR, J. D. Ruptured intervertebral disc and sciatic pains. *J. Bone & Joint Surg.*, 29: 429–437, 1947.
10. DANDY, W. E. Treatment of recurrent attacks of low backache without sciatica. *J. A. M. A.*, 125: 1175–1178, 1944.
11. POPPEN, J. L. Herniated intervertebral discs. Analysis of 400 treated cases. *New England J. M.*, 232: 211–215, 1945.
12. SPURLING, R. G. and GRANTHAM, E. G. The end results of surgery for ruptured lumbar intervertebral discs. A followup study of 327 cases. *J. Neurosurg.*, 6: 57, 1949.

13. Lenhard, R. E. End result study of the intervertebral disc. *J. Bone & Joint Surg.*, 29: 425–428, 1947.
14. Raaf, J. and Berglund, G. Results of operations for lumbar protruded intervertebral disc. *J. Neurosurg.*, 6: 160–168, 1944.
15. Caldwell, G. A. and Sheppard, W. B. Criteria for spinal fusion following removal of protruded nucleus pulposus. *J. Bone & Joint Surg.*, 30: 971–980, 1948.
16. Shinners, B. M. and Hamby, W. B. Protruded lumbar intervertebral discs, results following surgical and non-surgical therapy. *J. Neurosurg.*, 6: 450–457, 1949.
17. Marble, H. C. and Bishop, W. A. Intervertebral disc injury; analysis from an industrial standpoint. *J. Indust. Hyg. & Toxicol.*, 27: 103–109, 1945; Intervertebral disc injury, an analysis of 113 industrial cases. *J. Indust. Hyg. & Toxicol.* 31: 46–50, 1949.
18. Love, J. G. The disc factor in low-back pain with or without sciatica. *J. Bone & Joint Surg.*, 29: 438–447, 1947.
19. Bosworth, D. M. Clothespin graft of the spine for spondylolesthesis and laminal defects. *Am. J. Surg.*, 67: 61–67, 1945.
20. Frieberg, S. and Hirsch, C. On late results of operative treatment of intervertebral disc prolapses in the lumbar region. *Acta chir. Scandinav.*, 93: 161–168, 1946.
21. O'Connell, J. E. A. Indications for and results of the excision of lumbar intervertebral disc protrusions. A review of 500 cases. *Ann. Roy. Coll. Surg.*, 6: 403–413, 1950.
22. Berenn, S. N. Ruptured intervertebral disc syndrome. Is it an orthopedic or neurosurgical problem. *J. Omaha Mid-West Clin. Soc.*, 7: 63–69, 1946.
23. Shinners, R. M. and Hamby, W. B. The results of surgical removal of protruded lumbar intervertebral discs. *J. Neurosurg.*, 1: 117–122, 1944.
24. Cloward, R. B. The Treatment of Ruptured Lumbar Intervertebral Discs by Vertebral Body Fusion. Scientific Exhibit A. M. A. Convention. Atlantic City, June 11–16, 1951. Honorable Mention Award.
25. Cloward, R. B. Treatment of ruptured intervertebral discs by vertebral body fusion. IV. Statistical review of 262 cases followed up to 8 years. (In press.)
26. Barr, J. S. Sciatica caused by disk lesions. Forty cases of rupture of disc occurring in low lumbar spine and causing pressure on cauda equina. *J. Bone & Joint Surg.*, 13: 323–342, 1937.
27. Cloward, R. B. Changes in the vertebra caused by ruptured intervertebral discs. Observations on their formation and treatment. *Am. J. Surg.*, 84: 151–161, 1952.
28. Cloward, R. B. Recent improvement in the surgical treatment of low back pain due to ruptured lumbar intervertebral discs. *Hawaii M. J.*, 11: 279–285, 1952.
29. Lindbloom, K. Technique and results in myelogram and disc puncture. *Acta radiol.*, 34: 321–330, 1950.
30. Lindbloom, K. Backache and its relation to rupture of the intervertebral disks. *Radiology*, 57: 710–719, 1951.
31. Cloward, R. B. and Buzaid, L. L. Discography: technique, indications and evaluation of the normal and abnormal intervertebral disc. *Am. J. Roentgenol.*, 68: 552–564, 1952.

FAILURE OF FREEZE-DRIED ESOPHAGEAL GRAFTS*

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IF a satisfactory esophageal graft could be developed, it would be of important use in the treatment of such diseases of the esophagus as tumors,[1,2] perforation[3] and congenital atresia.[4] Esophageal grafts and prosthesis of various types have been tried with results which, although encouraging, have not been entirely satisfactory.[5]

The experience of the authors with freeze-dried arteries,[6] bone,[7] skin and tendon sheaths has been of such an encouraging nature that it has stimulated investigation of the use of freeze-dried esophageal grafts to correct esophageal defects in experimental animals. It was hoped that the results would be similar to those obtained with freeze-dried arteries which although biologically inert provide excellent mechanical support better than that provided by fresh grafts. A successful freeze-dried esophageal graft, if it acted in a similar fashion, would be an inert semi-rigid tube which would fulfill its most essential function, that of the transmission of food. Accordingly, in a group of five dogs defects were created in the middle third of the esophagus. These defects were filled with freeze-dried esophageal grafts.

The details of the technic of freeze-drying tissue for use as grafts is described elsewhere.[6] In these cases it consisted of washing the esophagus in a mixture of penicillin, streptomycin, terramycin, quick freezing in liquid nitrogen and sublimation of the water under a vacuum of 10 μ. At the time of use the tissues were reconstituted in physiologic saline for one hour at body temperature.

OPERATIVE TECHNIC

The fifth right rib was resected subperiosteally from just posterior to the angle of the rib to the costosternal junction. The fourth and sixth ribs were transected at their angles and the pleura entered. The lung and hilar structures were reflected anteriorly and the pleura overlying the esophagus incised. The azygos vein was isolated, ligated and divided, and the esophagus dissected free for a distance of approximately 8 to 10 cm. Non-crushing clamps were applied to the esophagus at the extremes of this dissection and a segment, approximately 4 cm. in length, was removed. The reconstituted freeze-dried esophageal graft was anastomosed above and below to the ends of the defect so created. The mucosa was anastomosed with No. 00 chromic catgut continuous sutures. The muscularis was approximated with No. 00 chromic catgut interrupted sutures and the serosa with No. 00 chromic catgut inverting sutures. The overlying pleura was loosely approximated leaving 1 sq. cm. openings in the right pleura. Antibiotic mixture was sprayed into the chest and the wound closed in layers, using silk interrupted sutures. The lungs were expanded by negative pressure through a catheter placed in the pleural cavity. The animals were given daily dosages of 300,000 units of crysticillin® and 1 gm. of streptomycin, intramuscularly. They were fed intravenously for the first five postoperative days and then orally with a mixture of beef bouillon and milk. The intravenous feedings consisted of glucose, saline, potassium salts and intravenous alcohol, bringing the daily intake to 2,000 calories. Water was given *ad lib.*, orally.

RESULTS

The first two dogs were accidentally given solid food on the fourth and seventh days, respectively. This was followed by development of respiratory distress in twenty-four hours and then toxemia and death. At autopsy, the suture lines were ruptured and solid food was free in the right hemithorax. Dogs 3, 4 and 5 were given the diet previously described, being placed on solid food no earlier than two weeks postoperatively. These animals did well, clinically, during the first few weeks after operation. However, after three to four weeks they showed loss in weight, difficulty in eating

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solid foods, and ultimately, difficulty in drinking fluids, and cachexia. Dog 5 died of pneumonia six weeks after operation in a cachetic condition. Dogs 3 and 4 were autopsied when it was quite evident clinically that esophageal stricture had occurred. This happened in dog 3 five weeks after operation and in dog 4 eight weeks after surgery. Autopsy of these three animals showed the esophagus to be constricted to a cross sectional area of 1 to 2 sq. mm. by firm dense fibrous tissue.

Histology. After freeze-drying and reconstitution the donor esophageal grafts, histologically, appeared normal. However, after implantation the grafts undergo rapid and severe degeneration. The esophagi in dogs 1 and 2 after five and eight days, respectively, showed almost complete disappearance of the muscularis and mucosa, leaving only a loose edematous network of collagen tissues and inflammatory cells in the graft area. Dogs 3, 4 and 5, which were autopsied from five to eight weeks after operation, showed a complete disappearance of the mucosa and inner layers of the muscularis with fibrosis of the outer layers of the muscularis and dense fibrous infiltration of the serosal region. This mass of scar tissue had contracted, with severe encroachment on the lumen.

COMMENTS

It is quite evident that these results are markedly different from the results obtained with freeze-dried aortic segments, bone segments or skin. Therefore, we must conclude that other factors are important in this tissue. The first and most evident of these factors is that of infection due to contamination by mouth secretions and food passing through the esophageal graft. However, exposure of freeze-dried aortic grafts to contaminants and salivary secretions followed by implantation in healthy soft tissue does not warrant this conclusion. Under these conditions only about 25 per cent of the grafts show significant infectious reaction. Therefore it seems that infection, *per se*, is not the important etiologic factor of the failure of these grafts.

The most notable difference in the esophageal and other homostatic grafts is seen immediately on microscopic examination. It has been repeatedly shown that the smooth muscle fibers of the freeze-dried aortic graft degenerate within forty-eight hours after implantation, leaving only an elastic network and collagen structure which resists physiologic blood pressure. The esophagus, however, does not contain this extensive elastic network which is present in the aorta. The degeneration of the smooth muscle cells leaves little structural support for the grafts, allowing rupture. This is confirmed from microscopic examination.

The flabby, edematous, degenerating muscle tissue of the graft allows the walls to come into contact. Fine fibroblastic adhesions form between these walls. Coincidental with this there is a massive invasion of inflammatory cells, including fibroblasts, into the muscularis and surrounding tissues. This invasion is apparently stimulated by products of the degenerating graft, such as is frequently observed around other degenerating tissues. As almost inevitably occurs in scar tissue contracture appears and reduces the lumen to only a small opening, functionally occlusive.

SUMMARY

Freeze-dried esophageal grafts were used to replace the middle third of the esophagus in five experimental animals. These animals were given antibiotics and intravenous feedings postoperatively. The experiments ended uniformly in failure. In two cases failure was caused by rupture of the graft and in three cases, stricture.

REFERENCES

1. Parker, E. E., Hanna, C. B. and Postlethwait, R. W. Carcinoma of esophagus. *Ann. Surg.*, 135: 697, 1952.
2. Myers, R. T. and Bradshaw, H. Benign intramural tumors and cysts of esophagus. *J. Thoracic Surg.*, 21: 470, 1951.
3. Weisel, W. and Forrester, R. Surgical treatment of traumatic esophageal perforation. *Surg., Gynec. & Obst.*, 94: 337, 1952.
4. Madden, J. L. Congenital atresia of the esophagus. *J. Thoracic Surg.*, 21: 460, 1951.
5. Berman, E. F. The experimental replacement of portions of the esophagus by a plastic tube. *Ann. Surg.*, 135: 337, 1952.
6. Pate, J. W. and Sawyer, P. N. Freeze-dried aortic grafts: preliminary report of experimental evaluation. In press.
7. Hyatt, G., Turner, T. C., Bassett, C. A. L., Pate, J. W. and Sawyer, P. N. New methods in preserving bone, skin, and blood vessels. *Postgrad. Med.*, 12: 239, 1952.

TENSION TENODESIS FOR RELAXED COLLATERAL LIGAMENTS OF THE KNEE*

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MOST injuries of the collateral ligaments of the knee are such as permit tendon repair or tenodesis without resorting to reconstruction operations. There are certain advantages in using the old injured, ruptured or frayed collateral ligaments instead of substitutes, even if two-stage operations are necessary.

Although there are many procedures to reconstruct and make taut the collateral ligaments—and probably the most commonly utilized methods are the technics of Bosworth,[1] Carrell,[2] Cotton,[3] Edwards,[4] Felsenreich,[5] Hey-Groves,[6] Marattoli[7] or Wilson[9]—there are certain final functional and mechanical disadvantages in each. Usually there is a loss of range of motion, which is sacrificed for stability of the knee articulation.

In the transplantation of the frayed tendon distally by the Mauck[8] block method the ligament is at a slight mechanical positional disadvantage and probably weakened by the lengthening procedure for tension; further, some rotatory weakness is induced as a result of the increased range of the "screw-home" action of the popliteus muscle. It is our contention, therefore, that the original site of the ligamentous attachment must be maintained for optimal mechanical advantages and is the basis of the countersinking osteotomy for tension tenodesis.

Some Anatomic Considerations. The ligamentous structures about the knee are so attached that they assume a position of maximum tension when the knee is maintained in complete extension. The rotary function of the knee is entirely absent at the position of full extension. As flexion is begun the tibia rotates several degrees on the femur (unscrews). The lateral collateral ligament is relaxed and the cruciate ligaments maintain their tension throughout all phases of flexion. The lateral play at the knee is greatest between the functional range of motion from 210 to 230 degrees. When the knee is placed at 270 degree flexion, only a few degrees of lateral motion are possible. In comparative examination of joints of various individuals in some a greater degree of relaxation of the ligamentous structure may be found; but when the proportion of clinical motion is exceeded, it is due to the injury or static tension with hyper-relaxation of the ligamentous structure.

The knee is so constructed and the ligamentous structures so displayed as to permit a rotation of the femoral condyle on the tibia. In flexion of the knee the internal condyle appears to be the fulcrum of rotation of the knee.

It is the maintenance of ligamentous integrity of the knee joint structure, which includes the two cruciates, two collateral ligaments, the posterior capsule, the popliteal ligament, the buffer action of the semilunar cartilages and also the anatomic configuration of the juxta-articular surfaces of the component structures of the knee joint, with which we are concerned. Structures which prevent the hyperflexion of the knee include the cruciate ligaments, the buffer action of the semilunar cartilages, posterior capsule, gastrocnemius, femoral insertion, and again the structural attitude of the articular surfaces of the knee joint, and also those muscles which cross the joint.

The normal function of the knee is dependent upon normal interplay of all the component structures of the knee. The quadriceps apparatus bears the keystone stabilization position for maintenance of normal integrity of the knee joint. Trauma to the knee joint is often followed by a severe rapid loss of muscle tone and power of the quadriceps apparatus, with resultant imbalance. The muscle structure is labile and

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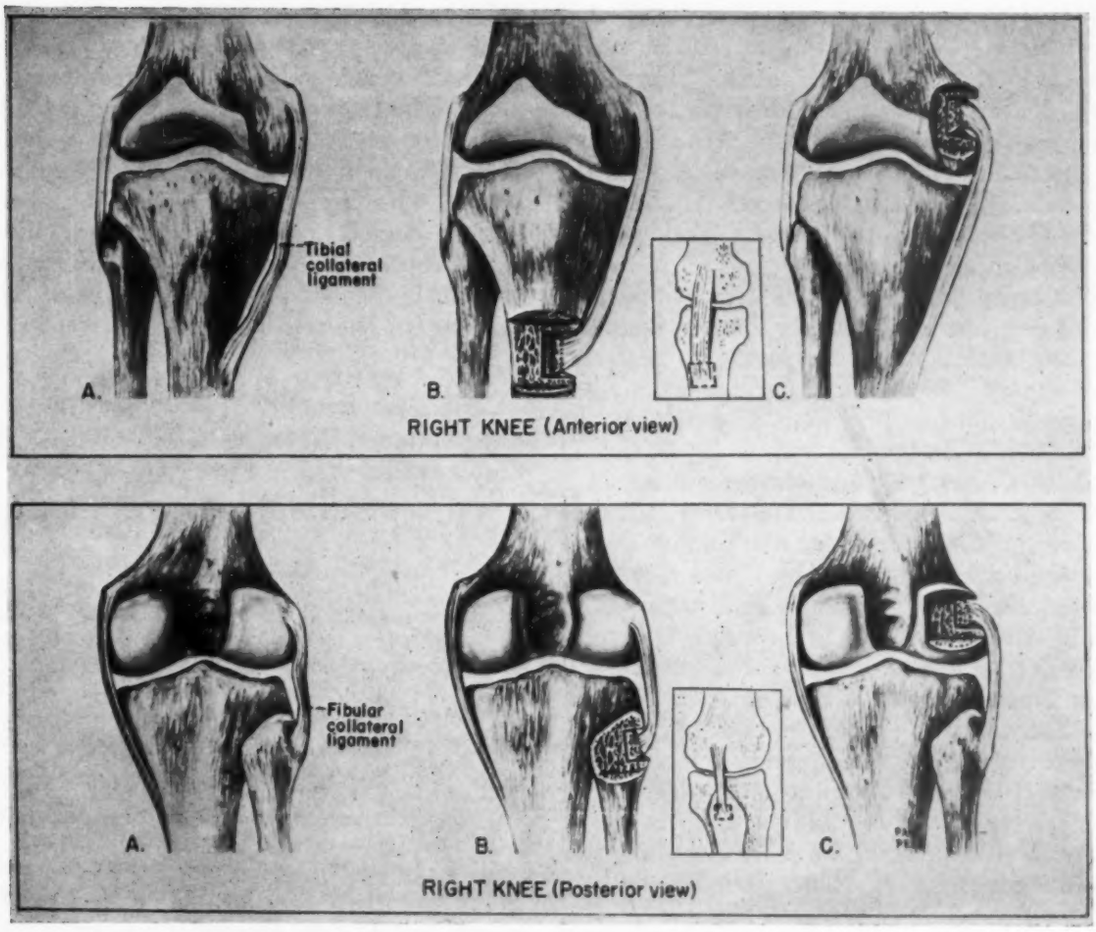

FIG. 1. Illustrates the countersinking osteotomy to tauten the medial and lateral collateral ligaments at either proximal or distal end.

its response to trauma leads to a marked atrophy of the musculature, particularly the vastus medialis muscle belly. With the loss of knee protection in the form of a strong normally functional quadriceps, reflex mechanism produces an unbalancing of the knee joint structures which according to Smillie initiates a vicious cycle of pathologic changes whereby effusion produces an inhibition of quadriceps action with secondary quadriceps atrophy. This passive unstabilization of the knee joint often produces effusion; this in turn is followed by immobilization of the joint structures and later by further atrophy of the muscle. The restoration of normal quadriceps action and power is paramount in the rehabilitation following injuries to the region of the knee. The vastus medialis muscle is one of the first of the quadriceps group to become disturbed and is usually the last to return to strong function.

The normal joint structures and in particular the articular surfaces must be maintained in order to anticipate a properly functioning knee following fractures.

According to Brantigan and Voshell the capsule, collateral ligaments and cruciate ligaments will control the lateral and rotary motion of the knee in full extension, while the same structures without the fibular collateral ligament will control the knee in flexion. They also state that the anterior cruciates prevent anterior displacement of the tibia on the femur and the posterior cruciate controls the backward displacement of the tibia on the femur. In spite of the loss of collateral ligament structure abnormal medial rotation often is limited by the twisting action of the cruciates. The medial collateral ligament is taut in all planes; all motion thereby in conjunction with the anterior and the posterior cruciate ligament takes an active part in the maintenance of the degree of rotation of the knee.

If both cruciate ligaments are divided while the lateral collateral ligaments remain intact, there is marked instability of the joint; however, on the other hand, when the collateral ligaments are divided, the cruciates will stabilize the knee. By twining on each other the cruciate ligaments in their crossed "X" position will obviate any abnormal medial rotation of the tibia on the femur.

The main stabilizers of the knee can be narrowed down to the internal collateral ligament and the anterior cruciate ligament. Further, even though the fibular collateral ligament is relaxed in flexion position, it shares in the stability of the articulation or it obviously would not be as large and strong as it is.

Relaxed or torn medial collateral ligament does permit some abduction motion in the joint once the knee is slightly flexed; and also there is some increased rotation range in the joint.

The site of attachment of these collateral ligaments has considerable mechanical import. Therefore a procedure is devised by the countersinking to preserve this site in an attempt to tauten the collateral as well as the internal ligaments of the knee surgically.[10] (Fig. 1.)

Method of Countersinking Osteotomy of Collateral Ligaments. In those patients selected for this procedure a routine exposure of the ligaments is made in its entirety. The ligament is then freed by careful dissection from the meniscus, check for rips or extensive fraying. In the case of the medial collateral ligament the transverse portion is divided from the vertical portion to permit tautening without interference with meniscus action if the latter is left *in situ*. Later this transverse portion is resutured after the countersinking procedure. Using a small osteotome a block of bone about the tendinous insertion is cut. This block of bone must be sharply peg-shaped, like a watermelon plug, with the apex deep and the base at the surface in cortical bone. A machinist punch is then used to drive the peg to the desired depth thereby getting the ligament at or to the desired tension. One can readily obtain firm fixation by this method; occasionally, however, it might be necessary to hold the peg with a pull-out Kirschner wire. The knee is then routinely closed. The leg is kept in approximately 20 degrees flexion in a cast or posterior splint for four weeks. Quadriceps exercises are begun on the third postoperative day in the cast. Weight bearing is permitted after the fourteenth day.

CONCLUSION

A countersinking tenodesis is presented which can be used in the repair of relaxed collateral ligaments of the knee.

REFERENCES

1. Bosworth, D. M. and Bosworth, B. M. Use of fascia lata to stabilize knee in cases of ruptured crucial ligaments. *J. Bone & Joint Surg.*, 18: 178–179, 1936.
2. Carrell, W. B. Use of fascia lata in knee-joint instability. *J. Bone & Joint Surg.*, 19: 1018–1026, 1937.
3. Cotton, F. J. and Morrison, G. M. Artificial ligaments at knee; technique. *New England J. Med.*, 210: 1331–1332, 1934.
4. Edwards, A. H. Operative procedure for repair of collateral ligaments of knee. *Brit. J. Surg.*, 8: 266, 1921.
5. Felsenreich, F. Über die Tecknik der vorderen Kreuzbandplastik mittels gestielter Fascienstreifen. *Zentralbl. f. Chir.*, 61: 1223–1227, 1934.
6. Hey-Groves, E. W. The use of fascial and tendon grafts in certain fractures and dislocations. *Ann. Surg.*, 100: 20–29, 1934.
7. Marattoli, O. R. Reconstruction de los ligamentos lateralis de la rodilla. *Rev. ortop. y. traumatol.*, 6: 2, 1936.
8. Mauck, H. P. New operative procedure for instability of knee. *J. Bone & Joint Surg.*, 18: 984–990, 1936.
9. Michele, A. A. Relaxed anterior cruciate ligament. *Surgery*, 27: 588–593, 1950.
10. Wilson, J. C. Reconstruction of internal lateral ligament of knee-joint. *J. Bone & Joint Surg.*, 4: 129–134, 1922.

RUPTURE OF THE RECTUS ABDOMINIS MUSCLE AND DEEP EPIGASTRIC ARTERIES*

A REVIEW OF 100 COLLECTED CASES, WITH THE REPORT OF ONE CASE

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RUPTURE of the rectus abdominis muscle and deep epigastric arteries is a specific surgical entity. Although these lesions are not too common, they are of special interest and importance because they have presented such a diagnostic problem and entailed an unnecessarily high mortality. It follows that since they are seldom seen, many of us are not always consciously aware of their occurrence. Moreover, our surgical and gynecologic textbooks make little or no mention of this subject.

Because the symptoms and physical signs of these lesions invariably suggest some serious intraperitoneal pathologic condition, the diagnosis has been mistaken for every possible acute intra-abdominal disease. It is the reaction of the peritoneum to the extraneous pressure of the hematoma produced by these accidents that causes the clinical picture to resemble falsely a severe intraperitoneal lesion. However, in the many laparotomies mistakenly performed in these cases not the slightest evidence of a pathologic condition in the peritoneum or abdominal cavity has been found.

In women the diagnosis has been confused with every conceivable intrapelvic disease, especially twisted ovarian cyst, ruptured tubal pregnancy and acute pelvic inflammatory disease.

Although some 450 cases were reported prior to this review, there is no doubt that many times this number occurred but were not recorded. In addition to the author's case this review covers 100 cases collected from forty-one articles in the medical literature from 1946 through 1952. Only twenty-two of these 101 cases were correctly diagnosed. (Table 1.)

In the second and third centuries Hippocrates and Galen described rupture of the rectus abdominis muscle and deep epigastric arteries. Prior to 1519 Leonardo Da Vinci, in his anatomic writings, made the observation that the lower third of the rectus muscle can contract 9 fingerbreadths, a distance of about 17 cm. In 1882 Maydl[7] published the first collective review of rupture of the rectus abdominis muscle. There were four deaths in his series of fourteen cases. In 1857 Richardson[9] reported the first case to appear in the American literature.

In collaboration with Cullen, Brödel[4] gave a detailed anatomic description of the deep inferior epigastric artery. To illustrate the vulnerability of this vessel to rupture, he noted that the artery ends in capillaries so minute that for their emptying they actually depend upon the contraction of the rectus muscle fibers. He states that minute thrombi, stasis following congestion and narrowing due to other causes can be factors in producing capillary obstruction. In addition, the lack of underlying bone structure permits massive hemorrhage when these vessels rupture.

Etiology. These cases can be grouped into the following five categories: (1) traumatic (direct and indirect violence), (2) pregnancy, labor and puerperium, (3) infectious diseases and diseases of inanition, (4) vascular degenerative diseases and blood dyscrasias, and (5) idiopathic. (Table 1.)

Direct violence: This class consists entirely of healthy, normal individuals who have been subjected to kicks, blows or falls in the region of the abdomen. In this category there was one case caused by a fall which proved fatal.

Indirect violence: The accident is caused by violent muscular effort such as horseback riding, heavy lifting, leaping and effort to maintain balance when falling. The European literature recounts many cases among cavalrymen, acrobats and gymnasts. Bowers and Richards[2] and others reported these accidents among parachute jumpers and commando trainees during World War II. Savitsky and

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Karliner[11] cited cases induced by violent tetanic convulsive contractions of electro-shock therapy. In this series there were ten cases due to indirect violence.

Pregnancy, labor and the puerperium: The pregnant woman is especially susceptible to rupture of the rectus muscle. Multiparas with poor musculature are often unable to withstand the stress and strain that is placed upon the epigastric vessels when the muscles are put to the test of internal pressure. Specifically, trivial strains like coughing, sneezing and over-reaching, as well as the extreme contractions of labor, can be the exciting factors in producing these lesions. The latter occur most frequently in the second half of pregnancy.

TABLE 1
ETIOLOGICAL CATEGORY AND MORTALITY IN 101 CASES OF RUPTURE OF THE RECTUS ABDOMINIS MUSCLE

Etiology	Non-pregnant		Pregnant		Total	
	No. of Cases	Mortality	No. of Cases	Mortality	Cases	Mortality
Direct violence	1	1	2	1	3	2
Indirect violence	10	0	6	0	16	0
Infectious diseases	29	2	35	4	64	6
Vascular diseases and blood dyscrasias	9	1	0	0	9	1
Idiopathic	6	0	3	0	9	0
Total	55	4	46	5	101	9

Forty-six cases, almost 50 per cent of the entire series, occurred in pregnant women. Of these forty-six cases, thirty-three were caused by coughing and sneezing incident to respiratory infections. Six resulted from strain of labor and two from falls. Influenza and typhoid fever accounted for one case each.

Five maternal and twelve fetal deaths indicate the gravity of these lesions in pregnancy. Respiratory infection accounted for four deaths; one death resulted from a fall.

Infectious diseases and diseases of inanition: Prolonged infections, typhoid fever, influenza, pneumonia, tuberculosis and syphilis, as well as diseases of inanition (avitaminosis), provide the background for this category. Here autopsies have disclosed rupture of the rectus abdominis muscle in areas of localized abscess formation and hyaline degeneration. Merely slight strains like coughing and sneezing brought on the accident. In this group there were twenty-nine cases, with two deaths.

Vascular degenerative diseases and blood dyscrasias: Sclerosis, hypertension and/or vascular degeneration of the deep epigastric arteries are the essential pathologic factors for rupture of the muscle and arteries in this group.

Axelrod and Kleinfeld,[1] and Carp[3] cited cases following dicumarol® therapy for thrombophlebitis and coronary infarction. Kinder[6] reported a case in a patient with auricular fibrillation; postmortem examination revealed complete occlusion of the inferior deep epigastric artery. Hemophilia and leukemia have been responsible for a number of cases. There were nine cases with one death in this category.

Idiopathic: This classification suggests that these lesions can occur without demonstrable causative disease. This is not likely. As has been noted, the epigastric vessels of even healthy individuals can show small scattered areas of sclerosis, hypertension and degeneration. Elderly patients are chiefly found in this category because rupture is more apt to occur spontaneously or from very slight exertion where there are degenerative changes in both muscles and vessels. There were six cases in this group.

Symptomatology. Following some trauma, either severe or mild, there is sudden onset of excruciating abdominal pain. The pain may be generalized but is usually localized to the site of rupture. Nausea and/or vomiting may be present. This acute phase may last only a short time; it is followed by a persistent, dull, aching pain.

Physical Findings. The patient appears acutely ill and may actually be in shock. Fixed in the abdominal wall is a hard, exquisitely tender and painful mass. The temperature ranges from 97° to 102°F. The blood count usually shows increased leukocytosis of from 10,000 to 13,000 white blood cells, with an increase in neutrophils of from 80 to 85 per cent. The general appearance of the patient gives every indication of a serious intra-abdominal pathologic condition.

There are four cardinal signs that should identify these lesions:

1. Payne[8] noted the absence of rigidity and tenderness in the abdominal wall adjacent to the mass in the rectus sheath. This is in contradistinction to what would be the case were the tumor situated intraperitoneally.

2. Fothergill[5] demonstrated that if the rectus muscles are made to contract by having the patient sit up, the mass can still be felt but cannot be moved from side to side. The mass is fixed in the abdominal wall. This is contrary to what would be expected were the tumor situated intra-abdominally.

TABLE II
SITE OF RUPTURE OF THE RECTUS ABDOMINIS MUSCLE IN 101 CASES

Right Rectus		Left Rectus		Not Mentioned
Upper 3rd	Lower 3rd	Upper 3rd	Lower 3rd	
1	47	3	18	32

3. Romanzew[10] observed that the limits of the swelling correspond to the limits of the rectus sheath. The mass does not extend beyond the midline medially nor beyond the lateral border of the rectus sheath laterally.

4. In slowly developing cases the most suggestive sign (Laffont's) is ecchymosis about the umbilicus; this discoloration spreads down the abdominal wall on the side of the rupture. In some instances it has involved the scrotum, anus and gluteal region.

Age, Sex and Site. Rupture of the rectus abdominis muscle and deep epigastric arteries can occur at any age. The youngest patient in this series was a four year old hemophiliac and the oldest patient was eighty-eight years of age. Most cases fall into two age groups: active individuals twenty-five to thirty-five years of age, and those advanced in years (sixty years and over). Excluding military personnel, these accidents occur more frequently in women. The ratio is at least 3:1. In this series there were eighty-one female and twenty male patients. The right rectus muscle is by far the most frequent site of rupture. The lower third of the muscle is involved in four of five instances. (Table II.)

Treatment. Early surgery is the treatment of choice. Military surgeons seem to prefer conservative measures, i.e., bed rest, heat and novocain infiltration for the pain. This can prove dangerous when there is a bleeding diathesis; almost all the fatalities in these lesions have been due to uncontrolled hemorrhage and shock. In fact the latter were the immediate causes of death in seven of the nine cases in the present series.

The surgical procedure consists of incision directly over the tumefaction, evacuation of the clots, ligation of bleeding vessels, preferably rubber dam drainage and closure of the incision. Transfusion and vitamin K therapy are instituted when indicated.

TABLE III
TREATMENT OF 101 CASES OF RUPTURE OF THE RECTUS ABDOMINIS MUSCLE

Type of Patient	Surgical	Non-surgical	Not Mentioned
Non-pregnant	48	7	0
Pregnant	29	12	5
Totals	77	19	5

In this series seventy-seven patients were treated surgically and nineteen had no operation. In four of the latter cases cesarean section was performed but the ruptured rectus muscle was treated conservatively. In five cases the treatment was not mentioned. (Table III.)

CASE REPORT

J. E. M., a sixty-nine year old white man, was admitted to the hospital on December 17, 1951, complaining of severe pain in the lower left abdominal quadrant. The night before admission, while sitting in a chair, the patient had been suddenly seized with severe pain in the left hypochondriac region of the abdomen. He was nauseated but did not vomit. He had had no bowel movement for three days.

Physical findings revealed the following: The patient, an elderly man in severe pain, looked acutely ill. Palpation of the abdomen revealed exquisite pain, tenderness and rigidity in the lower left abdominal quadrant. A hard, fixed mass the size of a grapefruit was felt in the lower left abdominal quadrant. Laboratory examination: red blood cells, 3,310,000; white blood cells, 12,700; polymorphonuclear leukocytes, 88 per cent; blood platelet count, 200,000; blood sugar, 114; blood urea nitrogen, 10.4; urine, negative.

A provisional diagnosis was made of intestinal obstruction, probably secondary to sigmoid

or rectal carcinoma. Flat x-ray plates suggested early intestinal obstruction of the left colon. However, repeated high enemas obtained bowel movements. A policy of watchful waiting was adopted. The second day after admission, ecchymosis appeared about the umbilicus and extended down the left side of the abdomen to the symphysis pubis. The pain persisted but was not so intense. On the fifth day after admission a barium enema x-ray study revealed no evidence of obstruction or neoplasm. At this time the patient recalled that in November, 1950, thirteen months prior to this hospital admission, he had been attacked by thugs, severely beaten and kicked in the abdomen.

Operation was performed on December 25, 1951, ten days after admission. Incision of the anterior sheath of the left rectus muscle immediately revealed a huge hematoma. Evacuation of the blood clots disclosed rupture of a branch of the deep inferior epigastric artery. In addition, the rectus muscle was torn and shredded. The bleeding vessel was ligated, a rubber dam drain was inserted and the incision was closed. After an uneventful recovery the patient was discharged on January 2nd.

The history and physical findings in this case presented three important clues for a correct diagnosis. These were entirely overlooked, namely, ecchymosis over the abdominal wall, a hard, fixed mass within the confines of the rectus sheath and the history of trauma thirteen months before admission.

SUMMARY

1. Because they are infrequently encountered, ruptures of the rectus abdominis muscle and the deep epigastric arteries have posed a diagnostic problem. Of the 101 cases reported in the last seven years, only twenty-two were correctly diagnosed.

2. It is only by coincidence that almost 50 per cent of the cases in this series have occurred in pregnant women. Nevertheless, the five maternal and twelve fetal deaths emphasize the seriousness of these lesions and the importance of a prompt diagnosis.

3. A correct diagnosis will lead to the intelligent management of these accidents and will depend upon: (1) an awareness of the occurrence of these lesions; (2) careful attention to the patient's history of even the most trivial incident of trauma; (3) the presence of a hard, tender mass fixed in the abdominal wall, confined to the limits of the rectus sheath, and in late cases the presence of ecchymosis about the umbilicus.

REFERENCES

1. Axelrod, M. and Kleinfeld, M. Unusual complications in dicoumarol therapy. *New York State J. Med.*, 51: 2789, 1951.
2. Bowers, W. F. and Richards, N. F. Rectus muscle strain simulating acute appendicitis. *Mil. Surgeon*, 92: 645, 1944.
3. Carp, G. A. Spontaneous hematoma of the rectus abdominis muscle simulating acute appendicitis. *J. M. Soc. New Jersey*, 48: 544, 1951.
4. Cullen, T. S. and Brödel, M. Lesions of the rectus abdominis simulating an acute intra-abdominal condition. *Bull. Johns Hopkins Hosp.*, 61: 295, 317, 1937.
5. Fothergill, W. E. Hematoma in the abdominal wall simulating pelvic new growth. *Brit. M. J.*, 1: 941, 1926.
6. Kinder, C. H. A case of spontaneous rupture of the inferior epigastric artery simulating acute intestinal obstruction. *Brit. J. Surg.*, 49: 88, 1952.
7. Maydl, K. Über subcutane Muskel und sehnen Zereissengen sowie Rissfracturen. *Deutche Ztschr. f. Chir.*, 17, 18: 306–361, 513–547, 35–139, 1882.
8. Payne, R. L. Spontaneous rupture of the superior and inferior epigastric arteries within the rectus sheath. *Ann. Surg.*, 108: 757, 1938.
9. Richardson, S. B. Rupture of the right rectus abdominis muscle from muscular effort. Operation and recovery with remarks. *Am. J. M. Sc.*, 33: 41, 1857.
10. Romanzew, N. Über Zereissungen der Musculi recti abdominis wärhend gymnaslicher Ubungen. *Ztschr. f. d. ges. Chir.*, 3: 645, 1913.
11. Savitzky, N. and Karliner, W. Rupture of the rectus abdominis muscle following electro-shock therapy. *J. A. M. A.*, 143: 431, 1950.

UNRUPTURED TUBAL TERM PREGNANCY

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UNRUPTURED tubal term pregnancy has been the literary stepchild of ectopic pregnancy. Abdominal pregnancy, of which about 300 cases have been published, and ovarian pregnancy (approximately eighty-six cases recorded) have been discussed extensively in all texts on obstetrics. There are also usually brief chapters on interstitial as well as intraligamentous pregnancy. Unruptured tubal term pregnancy, however, of which about seventy-five cases are known, has not found its official textbook recognition as yet. De Lee and Greenhill[11] as well as Eastman[14] do not describe this entity in their textbooks, although McCormick[41] makes a scant reference to a living fetus in an unruptured tubal sac. Only Stoeckel[61] in his text devotes more than a few lines to this topic, stating that the ovum occasionally matures to term in the tube. He accepts Lichtenstein's[32] theory that this is possible only if the placentation occurs close to the mesosalpinx where there is ample blood supply for the developing product of conception. He further adds that occasionally live fetuses have been obtained at laparotomy in such cases. However, the evidence of unruptured tubal term pregnancy appears so overwhelming that this condition should receive its due recognition just as the other late outcomes of ectopic pregnancy.

The first paper on ectopic term pregnancy in this country was published by Nathan Hale[25] in 1746. It is questionable whether this pregnancy was strictly intratubal. However, this case is quoted here because Hale stated that at autopsy the fetus was in the left tube (Ricci[53]). The fascinating story of Hale's remarkable details is aptly retold in Thom's[63] article. Osgood[49] published another case report in 1802. Since then approximately seventy-three cases have been reported in different countries. McElin and Randall[42] established four criteria necessary to diagnose unruptured tubal term pregnancy, paralleling Spiegelberg's[60] criteria for ovarian pregnancy. They added this pertinent statement: "The fundamental concept in our minds is therefore that of a fetus and placenta enclosed within the fallopian tube to such a degree that no other pelvic or intra-abdominal organ is involved in the formation of the sac and that salpingectomy alone is curative." Using these criteria to sift the cases of unruptured tubal term pregnancy reported in the literature, seventy-four cases are tabulated in Table 1. From this tabulation are excluded all reports which upon closer scrutiny appeared to be either abdominal, intraligamentous or interstitial pregnancies. Papers are also excluded which, although quoted in the literature as dealing with unruptured tubal term pregnancy, were not accessible.

Many authors have doubted the possibility of unruptured tubal term pregnancy following Werth's[75] dictum that an unruptured tubal pregnancy cannot proceed to term. However, like many other clinical dicta of the past, this also has been proven incorrect. As a matter of fact, the pregnant tube can expand to amazing dimensions. In eleven cases fetuses weighing from 7 to 10 pounds have been extracted from unruptured tubes.[22,26,32,33,43,46,48,55,59,73,77] In two cases twins were obtained.[15,19] On rare occasions intra- and extrauterine pregnancies have occurred simultaneously. Surprisingly enough, in one case[9] the tubal pregnancy went to term with a concomitant intrauterine pregnancy, whereas in a case reported by Knaggs and Walker[29] a recent intrauterine pregnancy of four months' duration was noted while a mature dead fetus was removed from the tube. In the former case[9] the intrauterine fetus delivered by cesarean section died in terms of hours, while the tubal fetus survived.

Unruptured tubal term pregnancies develop a stormy course due to peritoneal irritation. Dense intestinal adhesions were observed by all authors on operation. Rosenblatt[54] had to resect small intestines, and Markoff[38] a part of the sigmoid. Matlakowski's[40] and Kleeman's[28] patients died from intestinal injuries. Operative trauma to the urinary tract also has been described. In five instances unruptured tubal term pregnancy was found on postmor-

TABLE 1

SEVENTY-FOUR CASES OF UNRUPTURED TUBAL TERM PREGNANCY

Author	Age of Mother	Gravida	Para	Operation Performed	Child	Mother
Hale[25]	..	VIII	VII	16 yr. after term	Dead	Died
Osgood[49]	43	X	VI	Autopsy 17 yr. after term; no operation	Dead	.....
Meadows[44]	32	I	0	Near term	Alive	Died
Rampin and Deschamps[51]	43	III	II	Autopsy 7 yr. after term; no operation	Dead	.....
Simpson[57]	..	III	II	Autopsy 3 mo. after term; no operation	Dead	.....
Fraenkel[20]	..	III	II	Near term	Alive	Died
Litzman[33]	35	VII	VI	1 mo. after term	Dead	Recovered
Litzman[34]	37	II	I	3 wk. after term	Dead	Died
Brendel[4]	32	III	II	Near term	Dead	Recovered
Breisky[3]	30	II	I	Near term	Alive	Recovered
Eastman[13]	39	II	I	Near term	Alive	Recovered
Matlakowski[40]	40	VI	V	4 mo. after term	Dead	Died
Frommel[21]	36	IV	III	1 mo. after term	Dead	Recovered
Pepin[50]	37	I	0	Near term	Dead	Recovered
Lugeol[35]	39	II	0	At term	Dead	Recovered
Villar[68]	38	II	I	3 mo. after term	Dead	Recovered
Folet[19]	49	II	I	15 yr. after term, twins	Dead	Recovered
Yakovleff[30]	28	IV	III	7 mo. after term	Dead	Recovered
Fisher[18]	26	II	I	At term	Alive	Recovered
Lejars[31]	35	VII	VI	At term	Dead	Recovered
Augier[1]	29	III	II	2 mo. after term	Dead	Recovered
McGuire[43]	30	IV	III	7 mo. after term	Dead	Recovered
Masip[39]	35	IV	II	6 mo. after term	Dead	Recovered
Gruenbaum[24]	..	....	....	At term	Dead	Recovered
Morris[47]	..	....	....	4 mo. after term	Dead	Recovered
Verse[67]	23	....	....	At term	Dead	Died
Conway[8]	23	III	I	1 mo. after term	Dead	Recovered
Kleeman[28]	..	....	....	2 wk. after term	Dead	Died
Knaggs and Walker[29]	33	II	I	7 mo. after term; coexisting intrauterine pregnancy	Dead	Recovered
Chaput and Marchak[6]	37	I	0	3 yr. after term	Dead	Recovered
Werner[74]	26	I	0	At term	Dead	Recovered
Westenmark[76]	27	II	....	Near term	Dead	Recovered
Lichtenstein[32]	34	III	II	7 mo. after term	Dead	Recovered
Lichtenstein[32]	34	II	I	At term	Alive	Recovered
Smith[58]	32	IV	III	At term	Alive	Recovered
Gentili[22]	36	II	I	At term	Dead	Recovered
Hisgen[26]	27	II	I	6 wk. after term	Dead	Recovered
Hoehne[27]	..	....	....	Near term	Alive	Recovered
Rosenblatt[54]	36	II	I	4 mo. after term	Dead	Recovered
De Araujo[9]	29	I	0	At term; concomitant intrauterine pregnancy	Alive	Died
Ferrari et al.[16]	35	IV	III	3 mo. after term	Dead	Recovered
Williamson[77]	..	....	....	At term	Alive	Died
Brugeas[5]	..	....	....	2 mo. after term	Dead	Recovered
Lazarevic[30]	36	I	0	Near term	Alive	Recovered
Morgantini[46]	36	....	Multi	At term	Dead	Recovered
Watters[72]	34	III	II	11 yr. after term	Dead	Recovered
Markoff[38]	29	VII	III	At term	Dead	Recovered
Szlank[62]	31	I	0	At term	Alive	Recovered
Wechsler[73]	36	III	I	1 mo. after term	Dead	Recovered
Fink[17]	31	I	0	2 yr. after term	Dead	Recovered
Tottenham[64]	39	III	II	6 wk. after term	Dead	Recovered
Tottenham[64]	23	I	0	3 mo. after term	Dead	Recovered
Ferguson and Otis[15]	32	III	II	3 mo. after term, twins	Dead	Recovered

TABLE 1 (*Continued*)

Author	Age of Mother	Gravida	Para	Operation Performed	Child	Mother
Uchida[65]	52	....	....	Autopsy; no operation	Dead	.....
Schumann[56]	22	I	0	1 wk. after term	Dead	Recovered
Varner and Green[66]	20	I	0	Autopsy at term; no operation	Dead	.....
Wlassow[78]	32	VI	IV	4 wk. after term	Dead	Recovered
Decanio[10]	38	IV	III	At term	Dead	Died
Mahfouz[36]	..	....	....	.....	Dead	Recovered
Mahfouz[36]	..	....	....	.....	Dead	Recovered
Mahfouz[36]	..	....	....	.....	Dead	Recovered
Miller[45]	23	II	I	2 mo. after term	Dead	Recovered
Christitch[7]	30	III	II	2 mo. after term	Dead	Recovered
Slinger[59]	42	VII	VI	At term	Dead	Recovered
Wanderley[70]	30	....	....	11 yr. after term	Dead	Recovered
De Moura Carneiro[12]	26	II	I	7 mo. after term	Dead	Recovered
Wallau[69]	22	I	0	At term	Alive	Recovered
Braz[2]	42	III	II	5 mo. after term	Dead	Recovered
Mann and Meranze[37]	27	III	0	Near term	Dead	Recovered
Ross and Weekes[55]	32	VIII	VI	At term	Alive	Recovered
Ware[71]	30	III	II	15 mo. after term	Dead	Recovered
Woltz[79]	29	II	I	4 mo. after term	Dead	Recovered
McElin and Randall[42]	28	I	0	2 mo. after term	Dead	Recovered
O'Connell[48]	30	I	0	At term	Alive	Recovered

tem examination only.[49,51,57,65,66] Some of the fetuses were carried in the tube as long as three, seven, eleven and fifteen years.[6,19,52,70,72] During these periods subsequent intrauterine pregnancies occurred with normal outcome. Lithopedion formation seems to be rarer in unruptured tubal term pregnancy than in abdominal pregnancy. Only one such case in seventy-five has been found.[70]

The mortality of unruptured tubal term pregnancy prior to 1938 was distressing. Of forty-three women with dead fetuses operated upon prior to 1938, thirteen patients or 28 per cent died. Of thirteen mothers with live fetuses, five or 38 per cent died. The last known maternal fatality occurred in 1937. Since then seventeen patients have been operated upon without a death although in three cases live babies have been obtained.[48,55,69] These latter favorable statistics are undoubtedly due to blood replacement and antibiotic therapy as well as improved operative technic. Complete extirpation of the tube is desirable although this is somewhat easier if the fetus is dead and the placental circulation has ceased. It also has been accomplished of late with impunity in cases of live fetus. It is to be hoped that in the future the mortality in unruptured tubal term pregnancy will approach that of cesarean section. The over-all fetal mortality was 80 per cent.

The following case of unruptured tubal term pregnancy was observed by the author:

CASE REPORT

The patient was a forty-three year old white primigravida, sterile for sixteen years without contraceptive measures. The last regular period began February 6, 1950, and lasted four days. On February 15th painless staining occurred, lasting four weeks, and a negative Papanicolaou smear was obtained. Subsequently a diagnosis of intra-uterine pregnancy was entertained. The gestation period remained quite stormy. On March 17th a sudden onset of generalized abdominal pain occurred which lasted several hours. On the following day the pain subsided completely but staining appeared and continued until the end of the month. Three such episodes of abdominal pain occurred between April 7th and April 14th, accompanied by spells of vomiting. On July 11th another attack of pain and vomiting developed and again the pain subsided the following day but vomiting persisted. On August 30th the patient was hospitalized for ten days because of a temperature of 102°F. Glucose infusions and penicillin

FIG. 1. Hysterogram; lipiodol reaches fetal head.

FIG. 2. Cystogram.

were administered. On October 27th quickening stopped suddenly. Shortly before term intrauterine fetal death was considered and spontaneous onset of labor was awaited. Since labor did not occur for the ensuing six weeks after term, the patient was referred to the author for induction of labor.

Physical examination showed an elderly primigravida in fair condition. Blood pressure was 115/65; urine findings were normal. The erythrocyte count was 4,480,000 and hemoglobin was 12.5 gm. per 100 cc. There were 7,900 leukocytes. The blood was of group A, Rh positive.

On abdominal palpation the uterine fundus appeared to be 2 fingers below the xiphoid process. A single fetus was felt in vertex presentation on the left side. The head was floating and somewhat soft. Fetal heart sounds were absent.

On vaginal examination a round, hard mass the size of a three-month gestation was felt which was continuous with the cervix and extended to the right pelvic wall. The fetal head was palpated high above the round mass, which was interpreted to be the uterus. A tentative diagnosis of abdominal pregnancy was made and uterography was attempted for corroboration. (Fig. 1.) A cystogram was also taken. (Fig. 2.) The roentgenologic findings were misleading, showing a seemingly intrauterine dead fetus. The diagnosis, therefore, was changed to intrauterine pregnancy with dead fetus, six weeks after term.

Cesarean hysterectomy was decided upon and a low median laparotomy was performed on January 6, 1951, under spinal anesthesia. Immediately upon opening the peritoneum dense adhesions were encountered. The left tube was found to be dilated to the size of a uterus at term. The tube was covered entirely by omentum, transverse colon and small intestines which were densely adherent and had to be separated by both sharp and blunt dissection from the left tube. The uterus was enlarged, of irregular contour and was dextroverted. The vesicoperitoneum was reflected over the uterine fundus and the lower end of the left tube. The right adnexa appeared to be normal. There was no trace of a left ovary, which must have undergone complete atrophy due to pressure by the enormously dilated left tube. Total hysterectomy and a left salpingectomy were performed, leaving the unopened left tube attached to the uterus. (Fig. 3.) The specimen was dissected and a dead fetus was found in the enlarged tube. (Figs. 4 and 5.)

The right adnexa were left *in situ*. Serosal defects of the colon were repaired; the abdomen was closed in four layers and the skin with clips. A Levin tube was inserted at the end of the operation and retained for three days. The

FIG. 3. Uterus and unopened left tube.

the serosa of the fundus of the uterus. The covering serosa was rich in dilated blood vessels and in several places showed fibrous thickening. Inside this outer sac there was a thin, amniotic sac which contained a well developed female fetus 47.00 cm. long, weighing 4.5 lb. The circumference of the head of the fetus was 32.00 cm. in the frontosuboccipital diameter. The fetus was slightly macerated. Its skin was covered by meconium, soft, reddish and the epidermis in several areas was sloughed off. Examinations of the fetus did not reveal any malformation. The distribution, size and shape of the internal organs was normal. The organs of the fetus were congested. In the larynx, trachea and bronchi there was some greenish fluid. The stomach and intestines contained meconium.

"The thin placenta was located on the posterior wall of the lower half of the sac, and

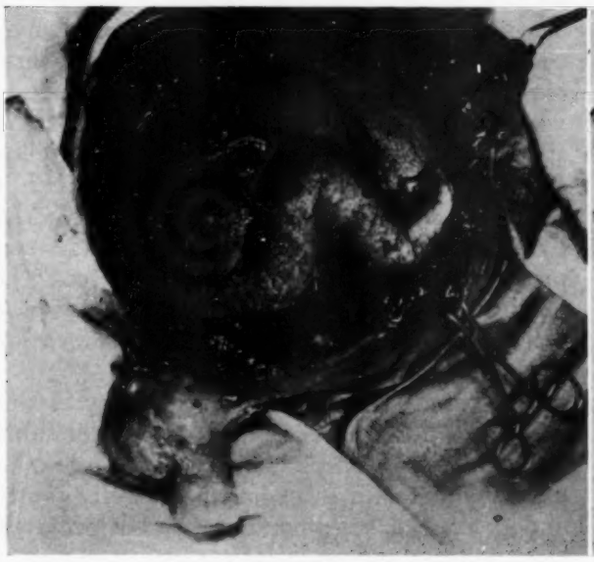

FIG. 4. Uterus and opened left tube. The fetus is in its original position.

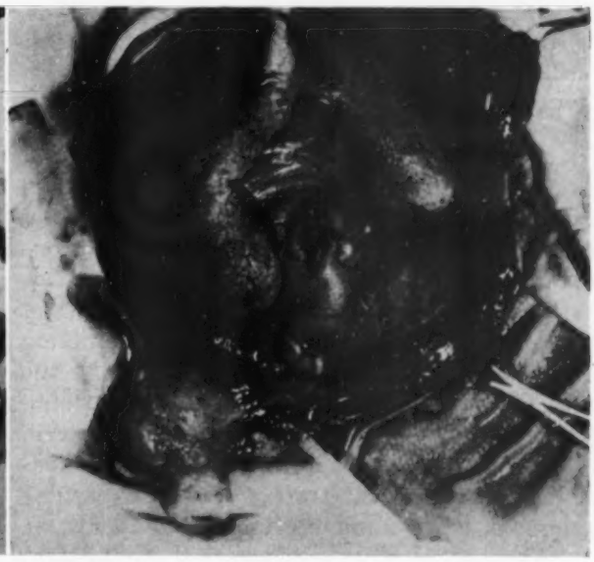

FIG. 5. The fetal head has been moved up from its original position.

patient made an uneventful recovery and was discharged on the eleventh day.

Repeated follow-up examinations revealed a firm abdominal scar and a well healed vaginal vault. When last seen the patient was well.

The pathologic report was as follows: "The specimen consisted of a uterus, to the left side of which a large sac was attached. The sac measured 23.00 cm. in diameter and its moderately firm wall was about 0.3 cm. thick; it was covered by serosa, which was continuous with it measured 14.00 cm. in diameter. It was grayish, soft and showed extensive confluent, necrotic areas. The umbilical cord was 34.00 cm. long.

"The uterus measured 7.5 × 6.0 × 3.5 cm. Its firm grey muscular wall was 1.3 cm. thick. The mucosa of the uterus was smooth, anaemic. A few small, well circumscribed, firm, greyish fibroids were present in the muscular wall of the uterus, the largest one measuring 1.0 cm.

"Microscopic findings: The wall of the sac,

FIG. 6. Microphotograph of tubal wall showing smooth muscles.

at the site of the left tube, was examined in many places histologically. Its wall was composed of edematous and congested fibrous connective tissue in which in many places few or several layers of well pronounced bundles of smooth muscle cells could be seen, resembling the musculature of the tube. (Fig. 6.) At the site of the placenta deep penetration of chorionic villi into the wall of the sac could be seen. The serosa showed congestion, fibrous thickening and slight infiltration by perivascular groups of chronic inflammatory round cells.

"Microscopically the placenta showed extensive necrotic areas with depositions of calcium salts.

"The mucosa of the uterus did not show decidual changes. The glands of the mucosa were slightly dilated and lined by typical tall non-secretory columnar epithelium, as in the early proliferative phase of the menstrual cycle. The small fibroids of the uterus were composed of interlacing bundles of typical smooth muscle cells and connective tissue fibers. The above described sac, at the site of the left tube, with an almost full term fetus in it, was the enormously dilated left tube, with thin but well pronounced continuous unbroken wall, still showing considerable amount of smooth muscle elements and covered by serosa.

"The specimen described was an unruptured tubal term pregnancy, located in the isthmic part of the left tube.

"The death of the fetus was caused by circulatory insufficiency near the end of the pregnancy."

COMMENT

Inspection of the specimen explained the seemingly incorrect roentgen findings. The uterine fundus being displaced to the right side, the wide opening of the dilated left tube was in direct continuation with the cervical axis. The tip of the cannula as well as the contrast medium therefore reached up toward the opening of the left tube and almost touched the fetal head. (Fig. 1.) This gave the erroneous impression of intrauterine pregnancy in contradiction to the previously entertained diagnosis of ectopic pregnancy. Hence the fractional hysterography was not continued after the first exposure and no further attempt was made to visualize the entire uterine cavity. Figure 2 shows the bladder filled with sodium iodide solution and the fetal head almost in the middle over the cervix, separated from the bladder by a considerable space. This space was interpreted as interposed placenta, whereas the operative findings showed that the fetus was distant from the bladder because of its location in the left tube.

The clinical course of the pregnancy in this case showed features common with other tubal term pregnancies, such as repeated episodes of abdominal pain and vomiting as well as early and prolonged staining. Fetal death occurred close to term and no labor ensued.

The extensive adhesions and fibroids and the age of the patient all contributed to the decision to perform total hysterectomy and left salpingectomy. Inspection of the specimen, which because of its rarity has been preserved *in toto*, showed the placenta to be on the posterior and inferior surface of the tubal lumen. This feature was also noticed in other cases of advanced unruptured tubal pregnancies and is compatible with Lichtenstein's theory of basiotropic placentation. Microscopic examination of the tubal wall showed the presence of smooth muscles which is essential for the pathologic diagnosis of this condition. (Fig. 6.)

SUMMARY AND CONCLUSION

A case of unruptured tubal term pregnancy, with dead fetus at operation six weeks after term, is presented and discussed together with a critical review of the literature.

Roentgen findings in this condition may be misleading. Although hysterography should be attempted in cases of suspected late ectopic pregnancies, the findings should be interpreted carefully. Apart from the more common abdominal pregnancy, the possibility of an unruptured tubal term pregnancy should be kept in mind in instances of this nature. In the differential diagnosis between unruptured tubal term pregnancy and intrauterine pregnancy the visualization of the entire uterine cavity is desirable. Uterograms done with small amounts of contrast medium may give the erroneous impression of an intrauterine pregnancy due to a wide direct communication of the dilated tube with the uterine cavity.

The unruptured tubal term pregnancy appears to be of sufficient significance to warrant its recognition as a pathologic and obstetric entity no less important than the various other late sequelae of tubal pregnancies.

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REFERENCES

1. Augier, D. M. Grossesse tubaire á terme. *J. d. sc. méd. de Lille*, 1: 581, 1905.
2. Braz, J. Sôbre um caso de gravidez tubária avançada. *Amatus*, 2 481, 1943.
3. Breisky, A. Zur Kasuistik der vorgeschrittenen Extrauterinschwangerschaft. *Wien. med. Wchnschr.*, 48: 1553–1559, 1887.
4. Brendel, I. M. Extrauterinschwangerschaft, Laparotomie im achten Monate. *Centralbl. f. Gynäk.*, 7: 649, 1883.
5. Brugeas, M. Grossesse tubaire opérée au onzième mois. *Bull. et mém. Soc. nat. de chir.*, 55: 429, 1929.
6. Chaput and Marchak. Grossesse tubaire á terme avec conservation de l'enfant. *Bull. et mém. Soc. anat. de Paris*, 88: 479, 1913.
7. Christitch, S. Un cas de grossesse tubaire opéré après terme. *Bull. Soc. gynec. et d'obst.*, 28: 264–267, 1939.
8. Conway, W. P. Tubal pregnancy unruptured at term. Transactions Philadelphia Obstetrical Society, p. 151, 1911–1913.
9. De Araujo, L. Coexistence of normal and ectopic pregnancies with full term viable fetuses. *J. A. M. A.*, 85: 1319, 1925.
10. Decanio, A. Gravidez tubaria a termo sem ruptura. *An. paulist de med. e cir.*, 34: 5, 1937.
11. De Lee and Greenhill. Principles and Practice of Obstetrics. Philadelphia, 1943. W. B. Saunders Co.
12. Carneiro de Moura, A. Gravidez tubária de termo. *Lisboa méd.*, 19: 22, 1942.
13. Eastman, J. Intraligamentous tubal pregnancy. *Am. J. Obst. & Gynec.*, 21: 929–931, 1888.
14. Eastman, N. J. Williams' Obstetrics, 10th ed. New York, 1950. Appleton-Century-Crofts, Inc.
15. Ferguson, J. A. and Otis, I. S. Full-term unilateral tubal pregnancy. *Am. J. Obst. & Gynec.*, 30: 139–141, 1935.
16. Ferrari, Houël and Jahier. Grossesse tubaire extirpée trois mois après la mort du foetus à terme. *Bull. Soc. d'obst. et de gynéc.*, 16: 215, 1927.
17. Fink, H. W. Full term tubal pregnancy. *Am. J. Obst. & Gynec.*, 28: 454, 1934.
18. Fisher, A. R. Two cases of tubal term pregnancy. *Protok. zasaid. Kavkazsk. med. Obsb.*, 39: 226, 1902.
19. Folet, M. Grossesse extra-utérine gemellaire datant de quinze ans. *Gaz. méd. de Par.*, 66: 127, 1895.
20. Fraenkel, E. Zur Diagnostik and operativen Behandlung der Tubarschwangerschaft. *Arch. f. Gynaek.*, 14: 197–220, 1879.
21. Frommel, R. Zur operativen Behandlung der Extrauterinschwangerschaft in den spaeteren Monaten der Graviditaet. *Münchcn. med. Wchnschr.*, 39: 1, 1892.
22. Gentili, A. Spora alcuni problemi riguardanti la gravidanza tubarica a termine. *Folia gynaec.*, 14: 41–83, 1921.
23. Grandval, A. Grossesse tubaire á terme. Thèse de fac. de med. de Paris., No. 223, 1832.
24. Gruenbaum, M., Eine ausgetragene Tubargraviditaet. *Münchcn. med. Wchnschr.*, 56: 1920, 1909.
25. Hale, N. A very remarkable case. *American Magazine*, pp. 219–221, 1746.
26. Hisgen, H. Eine ausgetragene Extrauteringraviditaet. *Zentralbl. f. Gynäk.*, 45: 490, 1921.
27. Hoehne, O. Ueber die weite und weitest vorgeschrittene Tubenschwangerschaft. *Zentralbl. f. Gynäk.*, 47: 145, 1923.
28. Kleeman. Ein Fall von ausgetragener Tubargraviditaet. *Zentralbl. f. Gynäk.*, 37: 500, 1913.
29. Knaggs, R. L. and Walker, W. W. A case of tubal pregnancy. Development to term without rupture. *Lancet*, 2: 75, 1912.
30. Lazarevič, V. Weit vorgeschrittene intakte Tubengravidität mit Ileussymptomen. *Zentralbl. f. Gynäk.*, 53: 3416, 1929.
31. Lejars, M. Grossesse tubaire á terme avec enfant mort. *Bull. et mém. Soc. de chir. de Par.*, 30: 979, 1904.
32. Lichtenstein, F. Basiotrope Placentation als Hauptbedingung dass Tubenschwangerschaften bis zum Ende getragen werden. *Zentralbl. f. Gynäk.*, 44: 657, 1920.
33. Litzman, C. Zur Feststellung der Indicationen fuer die Gastrotomie bei Schwangerschaft ausserhalb

der Gebaermutter. *Arch. f. Gynaek.*, 16: 343–355, 1880.
34. Litzman, C. Tubenschwangerschaft. *Arch. f. Gynaek.*, 16: 365, 1880.
35. Lugeol, J. Grossesse tubaire. Laparotomie á neuf mois et demi. *J. de méd. de Bordeaux*, 23: 1, 1893.
36. Mahfouz, N. P. Ectopic pregnancy. *J. Obst. & Gynaec. Brit. Emp.*, 45: 209–215, 1938.
37. Mann, B. and Meranze, D. R. Advanced unruptured tubal pregnancy. *Am. J. Obst. & Gynec.*, 46: 580, 1943.
38. Markoff, N. Extra-uterine pregnancy after the sixth month. *Rev. franc. de gynéc. et d'obst.*, 27: 73, 1932.
39. Masip, E. D. Un caso de embarazo tubárico á término. *Rev. ibero-am. de cien. méd.*, 17: 329, 1907.
40. Matlakowski, W. Zwei Faelle von extrauterine Schwangerschaft. *Arch. f. Gynaek.*, 38: 367–379 1890.
41. McCormick, C. O. Pathology of Labor, p. 337. St. Louis, 1947. C. V. Mosby Co.
42. McElin, T. W. and Randall, L. M. Intratubal term pregnancy without rupture. *Am. J. Obst. & Gynec.*, 61: 130, 1951.
43. McGuire, S. Tubal pregnancy going to term without rupture. *Old Dominion J. Med. & Surg.*, 3: 465–466, 1905.
44. Meadows, A. Case of gastrostomy for extra-uterine gestation. *Tr. Obst. Soc. London*, 15: 309, 1873.
45. Miller, H. A case of unruptured tubal pregnancy continuing to full term. *Tr. Edinburgh Obst. Soc.*, 97: 29, 1937.
46. Morgantini, H. Embarazo tubarico a termino. *Rev. méd. del Rosario*, 19: 255, 1929.
47. Morris, J. Unruptured tubal pregnancy of 13 months duration. *Lancet*, 1: 1469, 1910.
48. O'Connell, P. C. Full-term tubal pregnancy. *Am. J. Obst. & Gynec.*, 63: 1305, 1952.
49. Osgood, G. A remarkable extrauterine case. *M. Comm. Massachusetts M. Soc.*, 1 (part 2): 30–43, 1802.
50. Pepin, C. M. J. Grossesse tubaire de sept mois. *Bull. Soc. d'anat. et physiol. de Bordeaux.*, 13: 209, 1892.
51. Rampin and Deschamps. Fécondation pendant une grossesse extra-utérine. *Rev. de Therapeutique*, 44: 605, 1877.
52. Rampin and Deschamps. Fécondation pendant une grossesse extra-utérine, accouchement normal. *Lyon méd. Gaz.*, 26: 466, 1877.
53. Ricci, J. V. Genealogy of Gynecology, p. 501. Philadelphia, 1943. Blakiston Co.
54. Rosenblatt, J. Ein Fall uebertragener Eileiterschwangerschaft. *Zentralbl. f. Gynäk.*, 47: 554, 1923.
55. Ross, J. W. and Weekes, L. R. A full term live tubal pregnancy. *Am. J. Obst. & Gynec.*, 56: 1170–1173, 1948.
56. Schumann, E. A. Observations upon full term unruptured tubal pregnancy. *Am. J. Surg.*, 33: 570, 1936.
57. Simpson. Another case of extra-uterine gestation. *Edinburgh M. J.*, 12: 646–647, 1877.
58. Smith, R. E. Full time tubal pregnancy. *Lancet*, 1: 1163, 1920.
59. Slinger, L. A. P. A full-term unruptured ectopic gestation. *Brit. M. J.*, 1: 91, 1940.
60. Spiegelberg, O. Zur Casuistik der Ovarialschwangerschaft. *Arch. f. Gynaek.*, 13: 73–79, 1878.
61. Stoeckel, W. Seltenere Ausgaenge der Tubenschwangerschaft. Lehrbuch der Geburtshilfe, p. 698. Jena, 1923.
62. Szlank, J. Przypadek donoszonej ciaży pozamacicznej. *Ginek. polska*, 12: 30, 1933.
63. Thom, C. H. Late unruptured tubal pregnancy, pp. 119–126. Contribution from the Department of Gynecology of the City Hospital, N. Y., 1948–1949.
64. Tottenham, R. E. Some unusual cases of extra-uterine pregnancy. *J. Obst. & Gynaec. Brit. Emp.*, 41: 56–61, 1934.
65. Uchida, C. Ein anatomischer Fall von Eileiterschwangerschaft. *Taiwan Igakkai Zassbi.*, 34: 1402, 1935.
66. Varner, H. H. and Green, L. Ectopic pregnancy. *Southwestern Med.*, 21: 194–195, 1937.
67. Verse. Ueber Extrauterinegraviditaet. *Münchcn. med. Wchnschr.*, 57: 1970, 1910.
68. Villar, F. Un cas de grossesse tubaire laparotomie au douzième mois. *Arch. prov. de chir. Par.*, 3: 352, 1894.
69. Wallau, F. Ausgetragene Eileiterschwangerschaft. *Zentralbl. f. Gynäk.*, 66: 1298, 1942.
70. Wanderley, L. Ainda a gravidez extrauterina; um feto tolerado durante 11 anos. *An. brasil. de ginec.*, 10: 205–208, 1940.
71. Ware, H. H. Late extrauterine pregnancy. (Case No. 9.) *Am. J. Obst. & Gynec.*, 1948.
72. Watters, H. S. Mummified tubal pregnancy retained 11 years. *China M. J.*, 45: 782–786, 1931.
73. Wechsler, B. B. Tubal pregnancy at term. *Am. J. Obst. & Gynec.*, 25: 600, 1933.
74. Werner, P. Ueber einen Fall von ausgetragener Extrauteringraviditaet. *Ztschr. f. Geb. & Gynäk.*, 76: 397–407, 1914–1915.
75. Werth, R. Extrauteringraviditaet, v. Winckel's Handbuch der Geburtshilfe, p. 711. Wiesbaden, 1904. J. F. Bergmann.
76. Westenmark, K. Ein Fall von weit gediehener Tubenschwangerschaft. *Monatschr. f. Geburtsh. u. Gynäk.*, 46: 448, 1917.
77. Williamson, A. C. Tubal pregnancy at term. *Am. J. Obst. & Gynec.*, 15: 215–220, 1928.
78. Wlassow, W. N. Zur Diagnose der ausgetragenen ectopischen Graviditaet. *Monatschr. f. Geburtsh. u. Gynäk.*, 102: 22–29, 1936.
79. Woltz, J. H. E. Term tubal pregnancy. *North Carolina M. J.*, 11: 634, 1950.
80. Yakovleff, M. P. Tubal term pregnancy. *Bolnicznaya Gaz. Botkina.*, 7: 154, 1896.

UTERINE PROLAPSE*

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UTERINE prolapse, or falling of the womb, is one of the most neglected of gynecologic problems and is often mismanaged. Many women carry on their daily work with the uterus dropped either incompletely or completely. Soon discharges, extensive ulcerations or the fear of malignancy direct these patients to seek medical advice. A large percentage of patients with procidentia who have consulted physicians have been told that nothing could be done for them surgically. Conservative measures have been employed for years causing chronic irritations, discharges and severe general irritability on the part of the patients. Besides the neglect of those patients who have suffered in silence with this gynecologic condition, the medical profession also has been neglectful in the proper education of these patients. Mismanagement is partly the responsibility of the surgeon who lacks the adequate knowledge of anatomy, dynamics of the female pelvis, pelvic pathology, proper type of operative procedure and finally proper training, skill and experience in the management of prolapse uterus.

ANATOMIC DAMAGE

Uterine prolapse is the result of stretching or tearing, or both, or a deficiency or weakness of the endopelvic fascial and smooth muscle diaphragm from their attachments to the uterus and bladder. In cystocele the pubocervical portions of these diaphragms under the bladder may be damaged between the cervix and pubis. The degree of rupture and prolapse depends upon the extent of the injury, position and weight of the uterus, intra-abdominal pressure and the social status of the patient, not overlooking the stretching or tearing of the muscular levator diaphragm which helps to enlarge the outlet. Besides, an extensive laceration of the perineum with lack of support permits the uterus to prolapse to a greater degree by stretching or tearing of the rectovaginal prolongation of the endopelvic fascia, resulting in a prolapse with rectocele and even enterocele. This entire mechanism with herniation becomes more marked especially in women past the menopause with devitalized tissues. It is therefore necessary in order to obtain relief of symptoms to reconstruct the pelvic floor adequately and to repair damaged structures. A routine repair of the pelvic floor with correction of rectocele and enterocele are important steps of the procedure employed.

Types of Uterine Prolapse. When considering prolapse of the uterus an attempt should be made for an accurate definition of terms. Procidentia signifies a prolapse when a protrusion or eversion of the entire vagina is present with the descent of the cervix and fundus or a cervical stump. This entity is in contradistinction with the commonly known prolapse which is associated with infravaginal hypertrophy of the cervix with the partial descent of the vaginal wall, which remains in practically a fixed position. One can therefore consider procidentia as the last stage of a prolapse resulting from obstetric trauma, congenital lack of tissue elasticity and tonicity or following hysterectomy whether abdominal or vaginal. With a clear understanding that procidentia is the final stage of prolapse, it is suffice for this discussion to classify prolapse of the uterus into incomplete, complete and procidentia. Numerous classifications have been advocated by many surgeons. Ricci and Thom's[6] recent article on uterovaginal extirpation for procidentia gives a thorough review of the literature.

ANATOMIC DIFFERENTIATION

In prolapse the dense parametrial fibromuscular elastic tissue (the so-called Kock's ligamenta cardinalia or Mackenrodt's ligamentatum coli transversum or transversalis) attached

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to the lateral wall of the lower fundus, cervix and upper vaginal walls retain more or less their supportive powers. In procidentia these tissues become elongated, attenuated, non-resilient and non-supportive. In prolapse the anterior and posterior vaginal walls are in a partial descent and cystocele and rectocele may or may not be present. In procidentia a cystocele is invariably present and instead of a rectocele an enterocele is present. In neither prolapse nor procidentia does a urethrocele occur. This is because the vaginal and urethral walls are completely fused and are in close union with the periosteum of the ascending pubic rami.

SURGICAL TREATMENT

Prolapse is one of the conditions in gynecology for which many operative procedures have been advocated. It is apparent that variety suggests dissatisfaction with the methods employed. Phaneuf[4] discussed sixteen or more different methods for the correction of uterovaginal prolapse and allied conditions. The surgical correction of uterine prolapse is generally accomplished per vaginam in most clinics. Well trained gynecologists may disagree as to the particular type operation to be used. The most popular of the recognized procedures have their zealous and loyal advocates and the definite results vary little. The commonly used procedures are Manchester, Fothergill, Watkins, Schauta, Wertheim interposition and vaginal hysterectomy. It is not the purpose of this presentation to discredit any procedure for the surgical treatment of uterine prolapse but rather to present our experiences using vaginal hysterectomy for the surgical treatment of this condition.

For academic purposes Martin[1] of Berlin was the first to devise an operation for the excision of the uterus and vagina for procidentia. He also advised the removal of the adnexa. Edebohls[2] performed the first uterovaginal extirpation for procidentia in America in 1901. Many others have reported satisfactory results with simple vaginal hysterectomy.

Advantages. With vaginal hysterectomy a diseased or potentially diseased uterus is removed and all damaged structures are corrected. The broad ligaments, uterosacral ligaments and vesicovaginal fascia are all employed in the reconstruction of the pelvic floor and the support of the bladder. The ultimate result with vaginal hysterectomy is that the contraction and shortening of the ligaments actually lift up the anterior wall and vault. Kennedy[5] has clearly demonstrated this result even with the clamp technic.

With this procedure all structures are employed in pelvic reconstruction. A barren uterus including the cervix is removed. Therefore, there is no danger of recurrence or malignancy in a retained cervical stump. The postoperative complications and mortality are minimal factors. The follow-up and end result of this procedure are most gratifying to the patient because of relief of symptoms, feeling of well-being and freedom from fear of future complications. With experience, improved skill and knowledge of pelvic surgery the operation is easily and quickly performed.

Disadvantages. Vaginal hysterectomy is technically more difficult, but with experience it is less dangerous. It is not the operation for the surgeon not acquainted with pelvic surgery. It is not an operation for the child-bearing patient. A shortened vagina is not usually the rule with the technic employed, except in the aged with an extensive sacropubic hernia and poor tone and nutrition of tissues.

Indications. Patients at or near the menopause with symptoms of prolapse complete or incomplete with lacerations or climateric bleeding, or chronic cervicitis are best handled by vaginal hysterectomy. Recurrent prolapse following previous attempts of repair are ideal cases for this procedure, likewise prolapse of remaining cervical stump following supracervical hysterectomy.

Contraindications. The group of patients who are in the child-bearing age should not be subjected to such a radical procedure. In our experience carcinoma of the cervix or fundus of the uterus should not be removed by the vaginal route. Patients with associated adnexal pathologic disorders should be explored abdominally.

STUDY OF 1,098 CASES

The data collected in this series represent a total of 1,098 prolapse cases for a period of sixteen years. It is interesting to note that the radical therapy for prolapse of the uterus became more popular in our clinic after 1945.

Of the entire series (1,098 prolapse cases) 540 were incomplete, 281 complete and 277 procidentia. There were eleven nulliparas with

procidentia. More than 90 per cent of the patients were over forty years of age.

Symptomatology of this series presents the usual characteristic complaints of pelvic pressure, backache and abdominal pain in 80 per cent of the cases. Abnormal bleeding and urinary symptoms were present in 50 per cent and vaginal discharge and dyspareunia in 40 per cent. Many of these patients had several complaints while others complained only of a falling womb or a lump protruding from their privates.

TABLE I
TYPE OF OPERATION FOR PROLAPSED UTERUS

Operation	1936–1940	1941–1945	1946–1951	Total
Vaginal plastics	48	78	196	324
Vaginal hysterectomy	8	96	670	774

Of the operations for prolapsed uterus performed from 1936 to 1951 there were 324 vaginal plastics, either Manchester, Fothergill, Watkins interposition or Le Forte procedure. Vaginal hysterectomy, with and without removal of the adnexa was performed in 774 cases.

Table 1 shows the types of operation performed for prolapsed uterus over five-year periods between 1936–1940 and 1941–1945, and six-year period from 1946–1951. From 1936–1940 vaginal plastics predominated with a ratio of six vaginal plastics to one vaginal hysterectomy (forty-eight to eight cases). From 1941–1945 there were seventy-eight vaginal plastics to ninety-six vaginal hysterectomy cases. The latter group superseded the conservative procedure. From this period vaginal extirpation of the uterus for uterine prolapse began to become a more favorable procedure in our clinic. During 1946–1951 vaginal hysterectomy became practically the procedure of choice for most prolapse cases. In this group there were 198 for vaginal plastics and 670 for vaginal hysterectomy.

Besides the prolapse associated pathologic conditions were present. Infravaginal hypertrophy in some degree was noted in all cases, the degree depending on the type of prolapse. Cervicitis was present in 40 per cent, fibroid growth in 50 per cent, fibrosis uteri in 40 per cent, adenomyosis in 50 per cent, endometrial hyperplasia in 20 per cent, endometrial and cervical polypi each in 1 per cent of cases, and carcinoma of cervix and fundus of the uterus were present each in 0.5 per cent of this series.

Postoperative complications in this study are presented in Table II. Those complications listed as *immediate* occurred during a period of four weeks following surgery, and those classified as *late* were discovered after follow-up study of fifteen years. In the late group there may have been other complications which occurred but did not come to our attention.

TABLE II
POSTOPERATIVE COMPLICATIONS

	No. of Cases
Immediate	
Urinary Vaginal discharge	All
Infection	10
Vaginal bleeding	46
Severe internal hemorrhage	3
Embolic	1
Late	
Recurrent enterocele	55
Shortened vagina	10
Ovarian cysts	14
Prolapsed vagina	0
Eventration	0
Vaginal atresia	0
Fistulas	0

The immediate complications were urinary disturbances and vaginal discharge during the early postoperative period; cystitis and lack of bladder tone for four or five days postoperatively were present in practically all cases. The manipulation and trauma at operation with elevation of bladder are predisposing factors for an existing cystitis to flare up. Vaginal discharge was also common during this period because of all the suture material employed. In ten cases an exudate with subsequent drainage resulted, possibly because of slight accumulation of blood at the time of surgery. These complications occurred in the earlier group and prior to the use of antibiotics. Vaginal bleeding occurred in forty-six cases during the seventh to twelfth day postoperatively. This bleeding was controlled with vaginal packing and transfusion of blood if secondary anemia was present. There were three cases of severe internal bleeding, which necessitated laparotomy to control bleeding and replacement transfusions of blood. These cases were those associated with incomplete prolapse and parametritis in which the ligature had slipped from one of the uterine vessels. Recently, in a postoperative patient, one week after discharge from the hospital a

vaginal bleeding episode took place which was associated with internal bleeding. Laparotomy was performed and bleeding was discovered from the right broad ligament. The patient had been lifting her grandchild and pain suddenly developed in the right lower quadrant. This patient had had a simple vaginal hysterectomy for incomplete prolapse with fibrosis uteri. She made an uneventful recovery and was discharged twelve days postoperatively. There was one patient in this series who died of an embolus on the twelfth postoperative day after reaching home from the hospital.

Late complications are usually discovered from follow-up studies. In this series, there were fifty-five recurrent enterocele, which resulted in the procidentia group. In this latter group, there were ten with shortened vagina. Ovarian cysts were encountered in fourteen cases in the incomplete prolapse group. There were no cases of prolapsed vagina, eventration, vaginal atresia or fistulas.

Preoperative Investigation. Since most of these patients are neglected cases it is advisable that a complete preoperative investigation be made to determine the general status of the patient prior to surgery. A complete genito-urinary examination is routine because of the anatomic distortion of the ureters and urinary retention. Complete blood study, including blood chemistry, is also a routine procedure. A number of these cases reveal avitaminosis and secondary anemia. Transfusions and vitamins are given prior to operation. Diabetes mellitus has also been encountered and proper medical therapy to control this will prepare the patient for surgery. Ulcers of the vagina are treated locally. If edema is present, boroglyceride soaked tampons are used daily with the patient in bed in moderate Trendelenburg position. Antibiotics are used routinely. Senile vaginitis is treated with the administration of estrogens.

Anesthesia Employed. About 80 per cent of the patients received intravenous anesthesia of sodium pentothal using a dilute solution given by the continuous method as reported in a previous communication. The average dose used was 1.10 gm. This type of anesthesia is safe and has been used routinely since 1942. It is ideal combined with oxygen for the debilitated and aged, and patients suffering from fear complexes. No post-operative anesthetic complications have been noted.

The remaining 20 per cent of the earlier group of cases were done with local anesthesia using morphine and scopolamine preoperatively and 0.5 to 1 per cent solution of novocain by infiltration.

Operative Technic. The patient is first anesthetized using a dilute sodium pentothal solution by the continuous drop method as described in a previous communication. About thirty seconds after the needle has been inserted into one of the hand veins, the patient is placed in lithotomy position. The entire area is thoroughly scrubbed with chlorothymol solution, including thighs, vulval and perineal areas. Then the patient is draped and the vagina is bathed in chlorothymol and scrubbed. The bladder is emptied by catheterization. An examination is then made so that the interne may become acquainted with the pathologic condition present and confirm our previous findings. The table is then tilted to a slight Trendelenburg position. If abnormal bleeding is present, a diagnostic exploration and curettement of the uterus is performed.

With a Jacob's forceps the cervix is grasped and pulled down stretching both the anterior and posterior vaginal walls. The tissues about the uterus are then infiltrated with 0.5 per cent novocain solution containing about 1–2 minims of adrenal extract to 30 cc. of liquid. This procedure helps the dissection and sometimes controls oozing. A circular incision is made completely around the cervix similar to the type used for amputation. The posterior lip of the vaginal mucosa is grasped with Allis clamps and with gauze on finger, blunt dissection is made into the posterior cul-de-sac with the cervix held anteriorly. Then, with the index finger, the peritoneal cavity is explored to determine the size of the uterus and the condition of the adnexa. The uterosacral ligaments are clamped and ligated with chromic catgut No. 00. These sutures are permitted to remain long and held. Depending on the case the uterine vessels are clamped and ligated. When the prolapse is not marked it is sometimes advisable to divide the vaginal mucosa anteriorly, elevate the bladder and then ligate the uterine vessels. A small laparotomy pad is placed into posterior cul-de-sac to prevent peritoneal contents from dropping into the vagina and at the same time to absorb any fluid that may spill.

With the cervix pulled down the anterior wall is put on a stretch. A small incision is made on

the mucous membrane of the anterior vaginal wall and opened longitudinally with a Mayo scissors up to the urethral orifice. Three Allis clamps are placed on the edges of each flap of vaginal mucosa and with sharp and blunt dissection the bladder is separated from the underlying vesicovaginal fascia. If scar tissue is present, or the mucosa is adherent, a fine dissection with a scalpel may be indicated. In most cases the bladder and fascia are easily separated. Then the base of the bladder is elevated from the anterior aspect of the uterus with a sponge-covered right thumb. At times the cardinal ligaments of the bladder are clamped and ligated. The procedure outlined for the anterior wall is usually performed after tying the uterosacral ligaments to prevent hemorrhage from this area. At this stage the uterus is drawn down still further. The uterine vessels are visible and ligated, if they had not been previously clamped and ligated. The base of the broad ligament is then clamped and ligated.

At this point the uterovesical fold of peritoneum is opened. The uterus is then delivered with a finger in the cul-de-sac pushing the fundus anteriorly and cervix posteriorly. If the uterus is large, it is necessary to grasp the fundus anteriorly with a double Skene's tenaculum. With a small or moderate size uterus the index finger of the left hand is swept around behind the upper portion of uterus so as to push the fundus forward. The uterovesical fold of peritoneum is carried forward on the index finger. It is then incised and the fundus of the uterus is delivered and grasped with a double Skene's tenaculum. The round, uteroovarian ligaments and fallopian tube are clamped. The remaining portion of the broad ligament is clamped from below. The broad ligament is then incised and separated from the uterus, ligated and the suture held long. The vessels are then ligated with chromic catgut No. 00. The uterus is then turned laterally and the opposite round, broad ligament and fallopian tube are clamped and ligated. The broad ligament suture is left long and held in a manner similar to that described for the corresponding side. To remove the adnexa the uterus is brought extremely forward with a double Skene's tenaculum and the broad ligaments are clamped and ligated. The two long sutures of the broad ligaments stumps are then tied to act as a shelf to the elevated bladder. The strands of catgut are used to anchor the stumps of broad ligaments high to the pubic arch and held there. They are not tied until the anterior wall has been completed. Then the vesico vaginal fascia is dissected from the vaginal mucosa. The fascia is approximated with several interrupted chromic sutures. The long sutures of the uterosacral ligaments are tied together forming a similar shelf posteriorly. The last or posterior suture also grasps fibers of the uterosacral ligaments. This step of the procedure is most important and care should be exerted to include the fibers of the uterosacral ligaments properly. Upon this suture depends the prevention of late complication of enterocele. No attempt is made to close the peritoneum. The excess vaginal mucosa is excised. It is then approximated with two chromic catgut No. 00 continuous lock sutures, one starting from the posterior portion of vaginal mucosa and the other from the anterior portion, posterior to the urethra, both sutures meeting in the middle. The anchoring sutures of the broad ligaments are then tied in the midline. In cases of extensive uterine myomas it has been necessary to incise the capsule of the fibroids and shell them out individually. It may be necessary sometimes to bisect the uterus to remove some of the tumors.

Repair of posterior vaginal wall: With black silk as tension sutures at each side of the vagina, a transverse incision is made at the mucocutaneous junction. The vaginal mucosa is grasped by three Allis clamps and with a scalpel and blunt dissection is separated from the rectum. The scar tissue is excised. The mucosa is separated from the underlying structures by supporting its vaginal surface with the index finger and thumb of the left hand. With a gauze sponge in the right hand the rectum with its surrounding tissues is pushed backward. An inverted V shape portion of excess mucosa is excised. The apex of the inverted V and perirectal tissues are sutured with interrupted chromic catgut. The levator muscles are then approximated with interrupted buried sutures. To insure proper reconstruction of the pelvic diaphragm several superficial sutures may be inserted. The levator ani muscles immediately anterior to the rectum must also be approximated with chromic interrupted sutures. The perineal body must also be supported. The skin edges are then approximated with chromic interrupted sutures. All hemostasis controlled

and a small strip of iodoform gauze is loosely inserted into the vagina. A soft retention catheter is inserted into the bladder.

Postoperative Treatment. About one hour after surgery the patient is conscious and awake. Demerol 100 mg. is given every four hours if necessary. Intravenous glucose 5 per cent in saline is given, or blood transfusion if indicated. In our clinic blood transfusion is given practically routinely. Liquids are given orally *ad lib.* The following day the vaginal packing is removed and antibiotics are continued. The patient is permitted to dangle her legs for five to ten minutes. After forty-eight hours postoperatively the catheter is removed and patient is permitted to sit out of bed for five to ten minutes. The perineum is sprayed daily with an antiseptic solution. On the second or third day postoperatively a low soap suds enema is given and routine daily mineral oil is administered. The only distressing symptom between the third and fifth day is the inability to void. By forcing fluids, urinary antiseptics, catheterization, bladder irrigations and sedation, the bladder will function. Occasionally one or two doses of prostigmine 1:4000 accomplishes the desired result. From the fifth to the tenth day the patient is anxious to get home. On the tenth day patients are discharged and return for postoperative follow-up two weeks after discharge, and thereafter as instructed.

On discharge patients are advised: (1) keep alimentary tract open by drinking plenty of fruit juices and copious quantity of liquids between meals, or with use of mineral oil; (2) keep bladder empty frequently; (3) rest in morning and afternoon; (4) no routine heavy work or lifting; (5) avoid stair climbing; (6) proper diet; (7) Sitz baths daily or every other day; (8) warm daily vaginal douche.

SUMMARY AND CONCLUSIONS

1. In our experience vaginal hysterectomy and vaginal repair for the treatment of prolapse of the uterus has given us satisfactory results which have been most gratifying to the patients.

2. Vaginal hysterectomy is the procedure of choice employed in our clinic for prolapse of the uterus.

3. Vaginal hysterectomy produces repair of the pelvic structures with removal of the uterus, which is a potential source of future trouble.

4. A simple technic employed in our clinic has been described.

5. Complications, morbidity and mortality are minimal.

6. The procedure can be performed easily and quickly by well trained surgeons skilled in a knowledge of pelvic surgery.

REFERENCES

1. Martin, A. Ueber Extirpatio Vaginal. *Berl. klin. Wchnschr.*, 35: 910, 1898.
2. Edebohls, G. W. Panhysterocolpectomy. *M. Rec.*, 60: 561, 1901; *Tr. Am. Gynec. Soc.*, 26: 150, 1901.
3. Harrison, J. E. Vaginal repair combined with vaginal hysterectomy. *Am. J. Obst. & Gynec.*, 55: 403, 1948.
4. Phaneuf, L. E. *Surg., Gynec. & Obst.*, 77: 209, 1943.
5. Kennedy, J. W. and Campbell, D. Vaginal Hysterectomy. Philadelphia, 1942. F. A. Davis Co.
6. Ricci, J. V. and Thom, C. H. Uterovaginal extirpation for procidentia. *Am. J. Surg.*, 83: 192, 1952.
7. Brill, H. M. and Golden, M. *Am. J. Obst. & Gynec.*, 62: 528, 1951.
8. Doyle, J. C. Errors, omissions and suggestions in gynecology (particularly in management of uterine cancer and prolapse). *Ann. West. Med. & Surg.*, 4: 174–179, 1950.
9. Mazzola, V. P., Mazzola, N. J. and Mitchell, F. V. Vaginal hysterectomy; its place in gynecologic surgery: report of 1,140 cases. Submitted for publication.

ARTERIOVENOUS FISTULA AND SEPTICEMIA CURED BY EXCISION AND ANTIBIOTICS*

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TRAUMATIC arteriovenous fistula is an abnormal communication between an artery and a vein. This communication is established in the following manner. Incomplete puncture or partial tearing of the artery and its accompanying vein or an adjacent vein produces a hematoma which is common to both of the injured vessels. This pulsating hematoma may be palpable within hours after the injury, and a thrill and bruit soon follow. The hematoma is organized and hollowed out resembling a false aneurysmal sac, connecting the artery and the vein. These communications between artery and vein may be of many types depending upon the magnitude of the hematoma, the type and size of the openings in the artery and vein, and the location of these openings. If the openings are close to one another it may seem as if the artery and vein communicate directly. An arteriovenous fistula may occasionally occur by an infected area uniting the artery with an adjacent vein. Congenital arteriovenous fistulas are rare.

In a review of the literature of acquired arteriovenous fistula Holman found that William Hunter recognized this lesion as early as 1757. He described its characteristic bruit and thrill and showed that pressure over the sac or over the proximal artery could stop these physical signs. He also noted the enlargement of the proximal artery. Nicoladoni in 1875 and Branham in 1890 described what is popularly known as Branham's sign. This phenomenon is a slowing of the pulse during obliteration of the fistula by pressure. One of us (J. W. K.) showed that this was a reflex of the vagus since it could be prevented by giving the patient atropine.[11] In 1913 Stewart showed that the dilated heart diminished in size within ten days after correction of the fistula. Reid experimentally showed evidence of cardiac enlargement in the presence of arteriovenous fistula. In 1922 Gundermann showed elevation of blood pressure on obliteration of the fistula. Kennedy and Burwell demonstrated an increase in heart output and in blood volume in arteriovenous fistula as well as decreased circulation time and increased oxygen content in the limb containing the fistula, with normal readings in the unaffected limbs. Increased growth and caliber of limbs in children in whom arteriovenous fistula developed before they had reached maturity has been reported. The outstanding experimental work of Emile Holman has crystalized our conception of the pathologic physiology of arteriovenous fistula.

Subacute streptococcal septicemia associated with cardiovascular disease is not uncommon. Prior to the advent of antibiotics and new surgical technics this disease was almost uniformly fatal. Streptococcal septicemia may be divided into several types: (1) valvular disease (predominantly rheumatic, rarely syphilitic) with superimposed bacterial infection; (2) congenital cardiovascular abnormality with superimposed bacterial infection; (3) arteriovenous fistula with superimposed bacterial infection.

The causative organism is the non-hemolytic streptococcus in 95 per cent of the cases, alpha streptococcus in 80 per cent and gamma streptococcus in 15 per cent. Uncommon causes of this infection comprising 5 per cent include the Hemophilus influenzae, gonococcus, meningococcus, Bacillus melitensis, yeast, fungi, Actinomyces bovis, Histoplasma capsulatum, and the like.

The antibiotics may control the septicemia, but the hazard of reinfection and the hemodynamic changes induced by the arteriovenous fistula would make surgical intervention the desired treatment. Complete cure may be expected with surgical eradication of the anatomic defect.

CASE REPORT

E. P., a twenty-three year old single girl, gave a history of being accidentally shot by a

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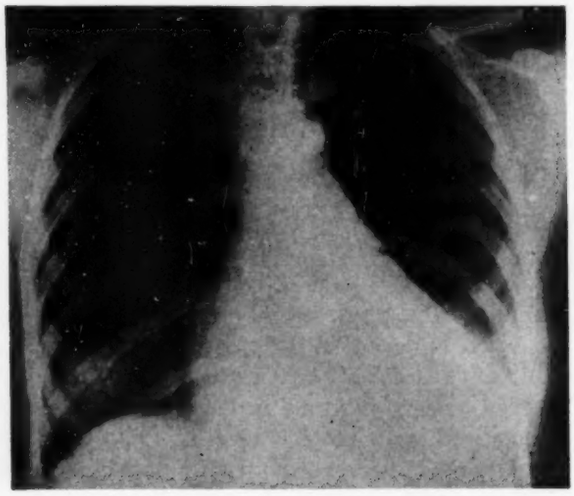


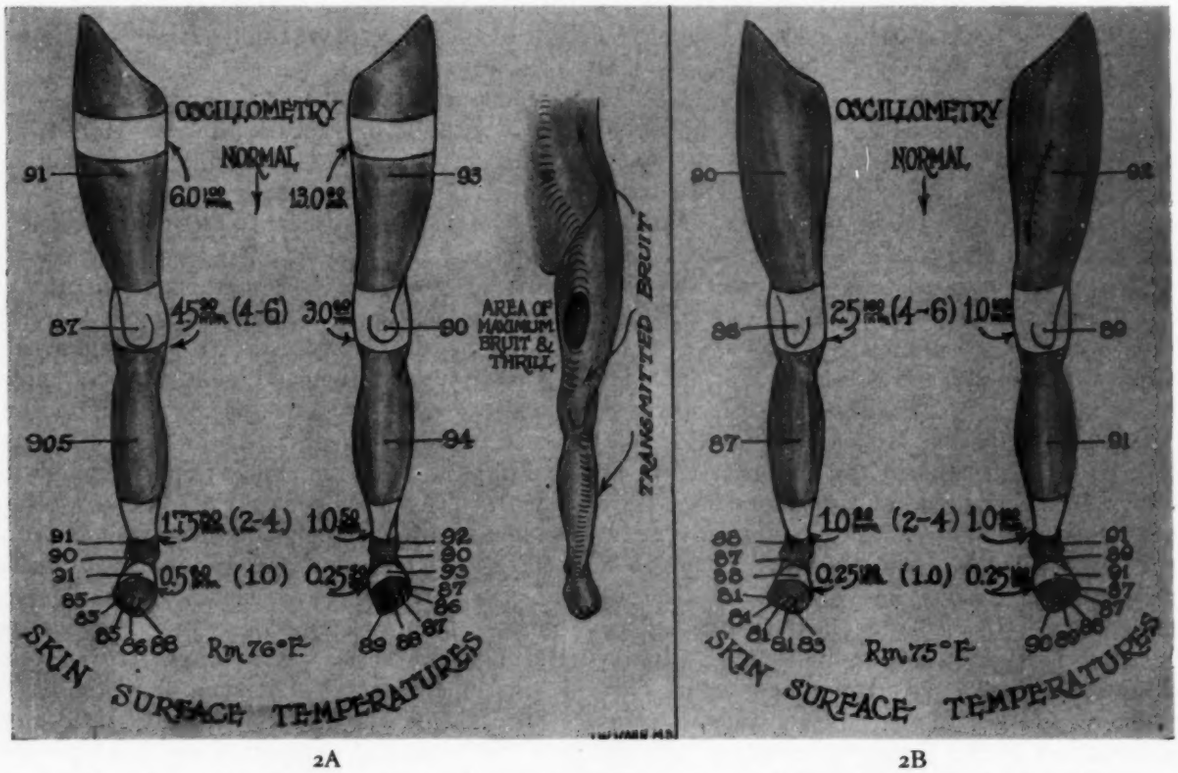
FIG. 1. Preoperative x-ray taken on November 15, 1950. Heart obscuring the outline of the left diaphragmatic leaf; cardiothoracic ratio 0.65.

years following injury) except for her knowledge of a "buzzing" sensation in the thigh when palpated.

In September, 1950, she had an upper respiratory infection with persistent temperature of 101–102°F. She did not respond to antibiotics administered by a local physician and was admitted to the medical service at Cumberland Hospital on October 3, 1950, for study.

Physical examination revealed an adult white female, well nourished, appearing acutely ill. The heart was moderately enlarged to the left. (Fig. 1.) There was a systolic murmur at the apex transmitted upward to the base. Blood pressure was 128 systolic, 65 diastolic.

Vascular survey showed the presence of an arteriovenous fistula situated in the anteromedial aspect of the mid-third of the left



2A 2B

FIG. 2. Vascular study of the limbs showing increase in oscillometric readings proximal to the fistula and decrease distally. Skin surface temperatures defining degree of skin collateral circulation. A, preoperative study; B, restudy four days after operation.

22 caliber bullet in the anterior aspect of the left mid-thigh ten years previously. The bullet entered the anterior thigh and showed a wound of exit at the same level on the posterior thigh. Bleeding was profuse and the patient had to be taken to a hospital for a few days. She was asymptomatic until September, 1950, (ten

thigh. (Fig. 2.) A thrill accompanied the bruit which was continuous and machine-like and was transmitted to the aorta proximally and to the vessels of the foot distally. The maximum bruit was heard over the sac just beneath the wound of entry. Oscillometry showed the typical increased readings proximal to the

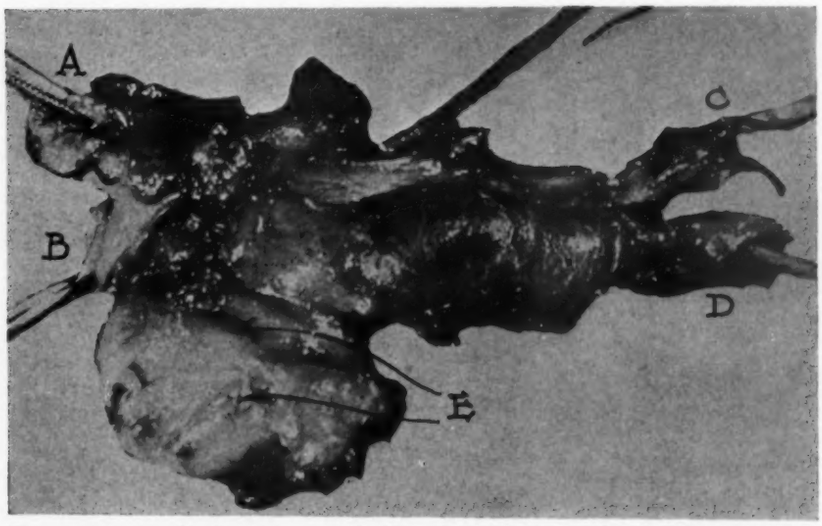


FIG. 3. A, proximal artery markedly dilated; B, proximal vein markedly dilated; C, distal artery about one-third the size of the proximal artery; D, distal vein normal in size; E, hard verrucal mass within the sac adjacent to the proximal vein. (From the Slide-of-the-Month Club Section, *Brooklyn Hosp. J.*, 9: 240, 1951.)

fistula and decreased readings distal to the fistula. (Fig. 2.) Readings on the opposite extremity were normal.

Skin temperature studies showed increased readings at all levels of the left, involved, lower extremity. Comparative circumferences showed some enlargement of the entire left limb of moderate degree as compared to the right. There were a few small caliber tortuous veins about the left leg.

There was slowing of the pulse from 100 to 80 per minute during obliteration of the fistula (positive Branham sign). Blood pressure changed from 144 systolic, 70 diastolic to 144 systolic, 100 diastolic during obliteration of the fistula by pressure and return to 140 systolic, 74 diastolic with release.

Significant laboratory findings were as follows: X-ray of heart showed a cardiothoracic ratio of .65; the cardiac shadow completely obscured the outline of the left diaphragmatic leaf. (Fig. 1.)

Repeated blood samples drawn from the antecubital veins revealed negative cultures. On the suggestion of the associate pathologist blood was drawn on two occasions from the femoral vein proximal to the fistula and revealed pure cultures of Streptococcus nonhemolyticus (alpha hemolysis). Sensitivity tests of the streptococcus showed the following: (1) penicillin: organism was inhibited by 0.125 units per cc.; (2) streptomycin: organism was inhibited by 10 μg. per cc. Numerous blood counts, urinalyses and various blood studies were non-specific. Repeated electrocardiograms were normal.

The presumptive diagnosis of subacute bacterial endangiitis was made.

Penicillin was administered in increasing doses up to 1,000,000 units every three hours in addition to aureomycin, 500 mg. every six hours for several weeks. The patient continued to have an elevated temperature. When streptomycin 1 gm, twice a day, was added, all evidence of active infection subsided within ten days. During this time the patient received four blood transfusions and general supportive therapy. She was then transferred to the surgical service.

The patient was operated upon on January 16, 1951. A longitudinal incision about 3 inches in length was made over the left femoral triangle exposing the femoral artery and vein. The artery and vein were freed and an umbilical tape was passed under each structure. The wound was then covered with a warm moist pad.

The major incision was made about 6 inches in length following the line of the lateral border of the sartorious muscle on the anterior aspect of the left mid-thigh over the region of the pulsating mass. The incision was carried through skin and fascia. The sartorius muscle was reflected medially and the rectus femoris muscle was reflected laterally. The roof of the adductor canal was incised and the sac in-

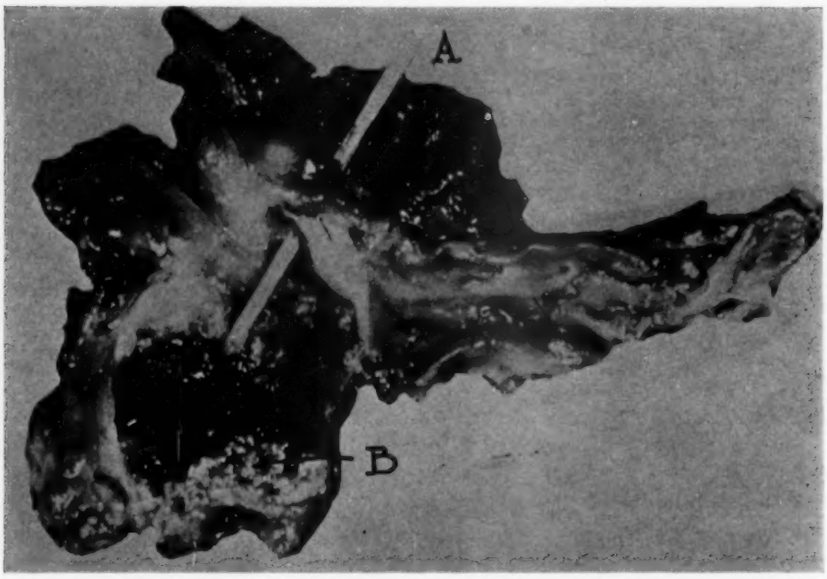


FIG. 4. Aneurysmal sac opened. A, probe passing through arteriovenous fistula; B, verrucae in sac. (From the Slide-of-the-Month Section, *Brooklyn Hosp. J.*, 9: 240, 1951.)

dentified. A quadruple ligation and complete excision of the arteriovenous fistulous sac was effected by the following steps. The distal artery and the distal vein were doubly ligated and divided. The sac was then mobilized. About ten large-sized collateral vessels entering the sac at various aspects and levels were dissected out, doubly ligated and divided. The sac was then completely mobilized and the proximal artery indentified, doubly ligated and divided. The ligation and division of the proximal vein completed the excision of the sac *in toto*.

The artery and vein in the femoral triangle were greatly enlarged. The artery was 1.5 cm. in diameter and the vein 2.0 cm. in diameter. These vessels were exposed as a control if hemorrhage was encountered during the excision of the sac. The artery distal to the sac was small, about 0.5 cm. The vein, distal, appeared normal and about 1.0 cm. in diameter. The collateral branches entering the sac were about 1.0 to 1.5 cm. in diameter. The proximal artery and vein were massively enlarged and were of the same caliber as encountered in the femoral triangle above. The sac (Fig. 3) was 6 cm. in length and about 4 cm. wide when engorged, and it vibrated with the swirling current of blood through the fistulous opening. At the medial upper pole of the sac in the region of the proximal femoral vein a hard mass about 2 cm. in diameter was felt. This caused a protrusion of the sac in teat-like fashion running medial and posterior to the afferent vein. Upon excision of the sac bruit and thrill were completely absent.

The wound was closed in layers with interrupted black silk sutures. One Penrose drain was inserted in the region of the adductor canal. The upper wound was similarly closed with no drainage.

Pathologic report: Figure 3 shows the resected mass with the main portion of aneurysmal sac at the site where the calcific foci are identified as a hard verrucal mass. The proximal artery and vein as well as the distal artery and vein are easily demonstrable.

Figure 4 shows the aneurysm opened and a probe passing through the arteriovenous fistula. The inner lining of this sac is studded with calcified vegetations in some of which colonies of streptococci were found. (Fig. 5.)

Figure 5 is a gram stain of a section through vegetations in the arteriovenous aneurysm, showing the fibrin strands of the exudated enmeshing gram-positive cocci occurring singly, in groups and in short chains (arrow). The irregular black masses are calcium deposits.

COMMENT

This is the seventh case of infected arteriovenous aneurysm reported cured by excision of the fistula. It is interesting to note the presence of bacteria within the "healed" vegetation of

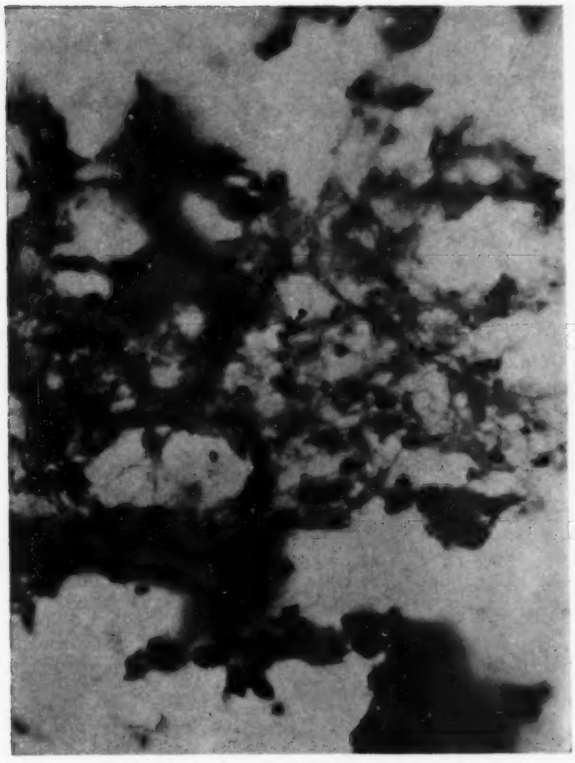


FIG. 5. Oil immersion magnification. Arrow shows gram-positive cocci occurring singly, in groups and in short chains. × 1800.

the excised segment of blood vessels. This is significant in view of the fact that the patient had shown a normal temperature, sedimentation time and blood count, and was considered clinically infection-free. One could presume that this patient would have had a recurrence of the septicemia if the arteriovenous fistula had not been removed.

The question always arises as to the optimum-minimum time for surgical intervention. It is our opinion that a waiting period of three months is sufficient for the establishment of a collateral circulation. During the period from March 1, 1944 to April 30, 1946, one of us (J. W. K.) had occasion to study and observe 339 patients operated upon for arteriovenous aneurysm in various parts of the body.* About 40 per cent of these patients were operated upon within three months of the time of the injury which caused the fistula. Objective studies of these patients showed no instance of residual circulatory insufficiency. In this study Dr. Elkin believed a delay of three months

* This study was made while associated with Drs. D. C. Elkin, M. Haymond Harris and F. W. Cooper, Jr., at Ashford General Hospital, the Vascular Surgical Center of the Army.

FIG. 6. Fifteen days postoperatively the heart is normal in size and shape.

was all that was necessary before operation, and this policy was carried out.[9]

It is interesting to note that three successive blood samples taken from the antecubital veins gave negative cultures, while two successive blood samples from the femoral vein yielded positive results.

The following possibilities are considered to explain this occurrence: (1) The pulmonary circuit filters out the bacteria. (2) The insertion of the needle close to the source of the bacteria may yield a greater concentration of the organism in the blood. (3) The bacteria lodged in the vegetation were partially sealed off and periodically, by the swirling current of blood, broke through with showers into the blood stream.

Postoperatively the patient had an attack of supraventricular paroxysmal tachycardia. This was stopped by intravenous cedilanid and by carotid sinus pressure.

A restudy of the oscillometric readings and skin surface temperatures, four days after operation as recorded on Figure 2, showed a diminution in the expansile impulse of the left popliteal artery. However, the oscillometric excursion of the tibial arteries above the ankle and of the pedal arteries about the foot remained the same as those of the preoperative study. This would imply at least the same degree of blood flow in the distal arteries despite ligation of the lower portion of the femoral artery. This phenomenon is apparently

due to an increased flow in the collateral channels. The skin surface temperature studies of the extremities after operation showed the left toes to be 6 to 8 degrees warmer than the corresponding toes of the right foot, whereas preoperatively there was a differential of only 1 to 2 degrees. This also implies an increased blood flow to the terminal vessels of the operated limb.

The diminution in heart size was very striking. X-ray of the heart, preoperatively, showed a cardiothoracic ratio of .65. (Fig. 1.) Fifteen days postoperatively the heart was normal in size and shape. (Fig. 6.) The systolic murmur was still present but of diminished intensity. The blood pressure which was 128 systolic, 65 diastolic preoperatively was 120 systolic, 90 diastolic postoperatively.

The following course of action is advised in the management of an infected arteriovenous fistula: (1) The organism should be isolated in the blood stream and tested for antibiotic sensitivity. (2) Adequate antibiotic therapy should be given until there is no clinical or laboratory evidence of active infection. (3) Surgical excision of the arteriovenous fistula (if three months or more have elapsed since the appearance of the fistula). In the event that the infection does not subside after a suitable trial period with antibiotics surgical removal of the fistula should be carried out even in the presence of the infection.

SUMMARY

A case of arteriovenous fistula with Streptococcous non-hemolyticus (alpha hemolysis) septicemia is presented. Unusual features in this case are discussed, as well as the successful treatment by antiobiotics followed by quadruple ligation and excision of the arteriovenous fistula.

Note: This patient left the hospital on March 11, 1951, in apparently good health. She returned to her home in Rhode Island where she was hospitalized on April 8th and died on September 17, 1951, with the diagnosis of disseminated lupus erythematosus (confirmed by autopsy).

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REFERENCES

1. Hamman, L. and Rienhoff, W. F. Subacute Streptococcus viridans septicemia cured by excision of an arteriovenous aneurysm of the external iliac artery and vein. *Bull. Johns Hopkins Hosp.*, 57: 219, 1935.
2. Touroff, A. S. W., Lande, H. and Kroop, I. Subacute Streptococcus viridans septicemia cured by excision of an infected traumatic arteriovenous aneurysm. *Surg., Gynec. & Obst.*, 74: 974, 1942.
3. Lipton, S. and Miller, H. Streptococcus viridans septicemica subacute bacterial endocarditis of an arteriovenous aneurysm. *J. A. M. A.*, 126: 766–769, 1944.
4. Shumacker, H. B., Welford, N. T., and Carter, K. L. Streptococcus viridans septicemia from vegetations in femoral arteriovenous aneuyrsm. *Ann. Surg.*, 124: 123–130, 1946.
5. Statland, M. and Orr, T. G. Streptococcus viridans endarteritis of an arteriovenous aneurysm cured by penicillin and surgical excision. *J. Lab. & Clin. Med.*, 34: 221, 1949.
6. Williams, M. H. Cure of traumatic arteriovenous aneurysm and streptococcus septicemia with penicillin and operation. *J. A. M. A.*, 148: 726–728, 1952.
7. Friedberg, C. K. Diseases of the Heart. Philadelphia, 1949. W. B. Saudners Co.
8. White, P. D. Heart Disease. New York, 1951. The Macmillan Co.
9. Elkin, D. C. and Cooper, F. W., Jr. Personal communication.
10. Robertson, R. L., Dennis, E. W. and Elkin, D. C. Collateral circulation in the presence of experimental arteriovenous fistula. *Surgery*, 27: 1–16, 1950.
11. Kramer, M. L. and Kahn, J. W. Effect of atropine on the Branham sign in arteriovenous fistula. *Arch. Int. Med.*, 78: 28–30, 1946.

BILIARY FISTULAS*

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BILIARY fistulas are interesting surgical problems which usually reflect advanced biliary disease or surgical error. A series of fifty-three fistulas discovered at the Boston City Hospital during the years 1932–1952 was examined to review the pathogenesis and prognosis.

EXTERNAL FISTULA

Twenty-three cases of external biliary fistula were found. The average age was fifty-six years; twelve were women and ten were men.

The usual signs and symptoms are those pertaining to fistulous discharge and residual biliary disease. One can learn much concerning the type of fistula from the character of the discharge: mucous discharge without bile means complete cystic duct stenosis; bile-stained mucus, intermittent cystic duct obstruction; large quantities of bile, choledochal disease; large quantities of bile and pus, cholangitis. If the fluid losses are great, dehydration and nutritional disturbances may be found. The symptoms of residual disease may be upper abdominal discomfort of varying intensity, jaundice, or chills and fever. All of the patients reviewed had upper abdominal discomfort and nine of the twenty-three had jaundice.

Every case followed surgical treatment of biliary disease; eight cases followed cholecystostomy, six cases followed cholecystectomy, seven followed choledochostomy and two followed biliary anastomosis.

The cause of the fistula was as follows: gallbladder remnant, eight; stricture, nine; common duct stone, three; biliary-intestinal anastomosis, two; cancer, one. (Fig. 1.)

Gallbladder remnant: The eight cases demonstrating a gallbladder remnant followed cholecystostomy. In addition to the distress of a long-standing fistula all these patients had abdominal discomfort of some degree. Stones definitely reformed in three of the group and probably in the remainder. One patient died from a ruptured gallbladder two years after the fistula closed spontaneously.

These cases emphasize that cholecystostomy is an emergency procedure to be used only in patients in extremely poor physical condition or when a severe inflammatory process prevents cholecystectomy. If the physical condition permits, a removal of the gallbladder should be done at a later date when the inflammation has subsided.

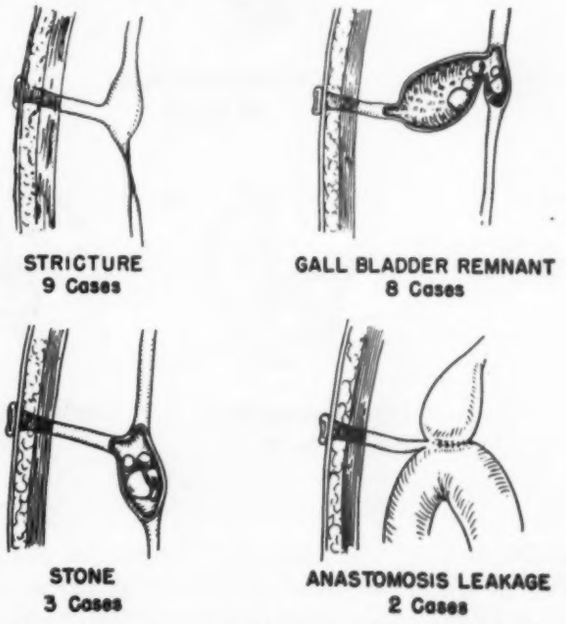

FIG. 1. The causes of external biliary fistula in twenty-three cases reviewed at the Boston City Hospital.

Stricture: Two of the strictures followed previous cholecystectomy and seven followed choledochostomy. Three patients were not operated upon: the first died in three weeks from overwhelming cholangitis; the second healed spontaneously but recurrent jaundice and chills resulted in death with multiple liver abscesses and cholangitis; the third fistula healed spontaneously but recurrent right upper quadrant distress persisted.

Six patients were treated surgically. The first had a Vitallium tube reconstruction which functioned for six months with recurrence of jaundice caused by inoperable carcinoma of the

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pancreas. The second had the fistula implanted into the stomach, which functioned for several years with recurrent right upper quadrant distress and jaundice. The third had a choledochoduodenostomy which relieved the jaundice, but death occurred in eight months from multiple liver abscesses and cholangitis even though the anastomosis was patent at autopsy. The fourth was treated by a hepaticojejunostomy with an associated jejunojejunostomy. This did not relieve the patient and a fistula with occasional bouts of chills and fever persisted. In the fifth case several attempts were made to repair the fistula by plastic repair but two years following surgery the patient was still experiencing recurrent attacks of jaundice with chills and fever. In the sixth case reexploration revealed the common duct to be completely divided; it was then repaired. A duodenal fistula ensued but the patient eventually recovered.

All of these cases represent injury to the common duct at the time of previous surgery and emphasize the need of good exposure, careful technic and previous training for successful biliary surgery. Much has been written on this subject by various authors.[1–3]

In addition these cases emphasize the miserable course of common duct strictures if successful surgical care is not undertaken. Such surgical care is not the topic of this paper, but briefly, it consists of an end-to-end biliary duct anastomosis with a functioning sphincter of Oddi whenever possible. This should be feasible in many cases using the principles outlined by Lahey.[1] If this cannot be done, a biliary intestinal anastomosis will be necessary.

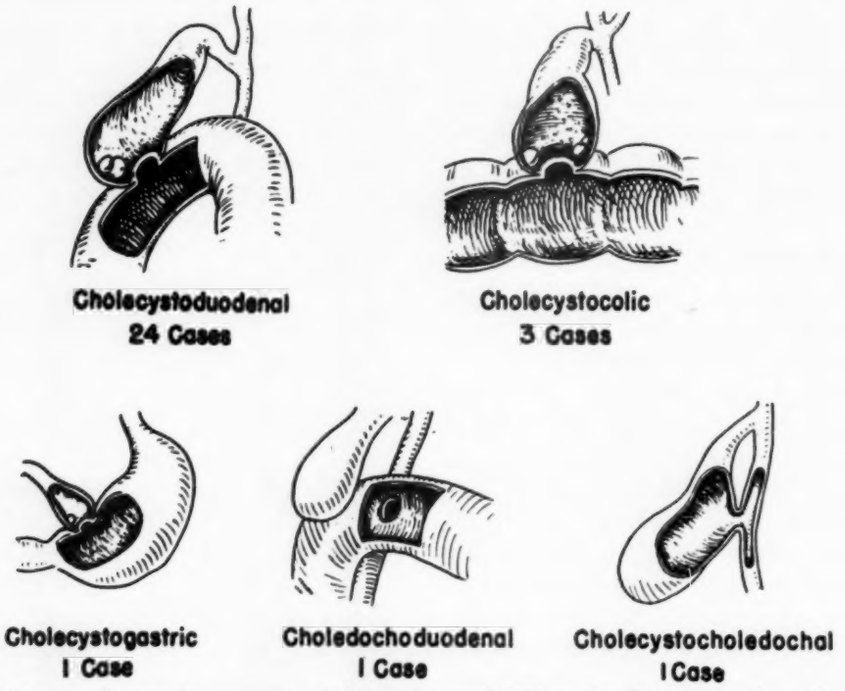

FIG. 2. Anatomic patterns of thirty internal biliary fistulas reviewed at the Boston City Hospital. Causes: twenty-nine due to gallstones; one due to cancer.

Common duct stone: Three external fistulas were due to residual choledocholithiasis and all followed previous cholecystectomy. In one instance tiny gallstones were found in the gallbladder at the time of surgery.

These cases of choledocholithiasis which were unrecognized at the time of operation should make us reflect on the usual indications for choledochostomy. A history revealing obstructive jaundice, biliary colic with chills and fever, or pancreatitis should make one suspicious of common duct stones. The following operative findings should also indicate common duct exploration; palpation of stones in the common duct, distended common duct, aspiration of pus or muddy bile from the common duct through a hypodermic needle, and stones in the gallbladder which are small enough to pass through the cystic duct. Operative cholangiography may be of value in this regard.

Cholecystojejunostomy: Two cases followed

anastomosis of the gallbladder to the jejunum. One of these was an attempt to repair a stricture of the common duct; the second was a bizarre case in which a Miculicz procedure was utilized in performing the anastomosis at another hospital. At reoperation no choledocholithiasis or cholecystolithiasis was evident. The fistulous tract was excised; the opening in the jejunum closed; and the gallbladder removed with subsequent normal recovery.

Cancer: One case of persistent external biliary fistula followed the removal of a carcinoma of the gallbladder, and this patient died approximately five months following surgery. This case teaches us little other than the usual poor prognosis of the disease.

INTERNAL FISTULA

Thirty internal biliary fistulas were reviewed and their anatomic pattern studied. The average age group of this series was seventy years, indicating that these fistulas are usually the result of long-standing biliary disease. Twenty-two of the cases were in women and eight in men.

The most common anatomic pattern of the fistula was as follows: cholecystoduodenal, twenty-four; cholecystocolic, three; cholecystogastric, one; cholecystocholedochal, one; choledochoduodenal, one. Gallstones were the cause in twenty-nine cases and carcinoma of the gallbladder in one. (Fig. 2.)

Gallstone ileus: Sixteen of the cases produced gallstone ileus and in every case the fistula was the cholecystoduodenal type.

The diagnosis of gallstone ileus can often be made preoperatively. There will be the usual signs and symptoms of small bowel obstruction, i.e., periumbilical crampy pain, obstipation and vomiting.[4] In such cases the diagnosis of gallstone ileus may be suspected if there are no hernias or abdominal scars but there is a history of gallbladder disease. (Fig. 3.) X-ray may sometimes lead to the correct diagnosis if a stone is seen in the lower abdomen at the site of the obstruction, or if a gas pattern can be seen in the normal liver shadow in association with small bowel obstruction. (Fig. 4.)

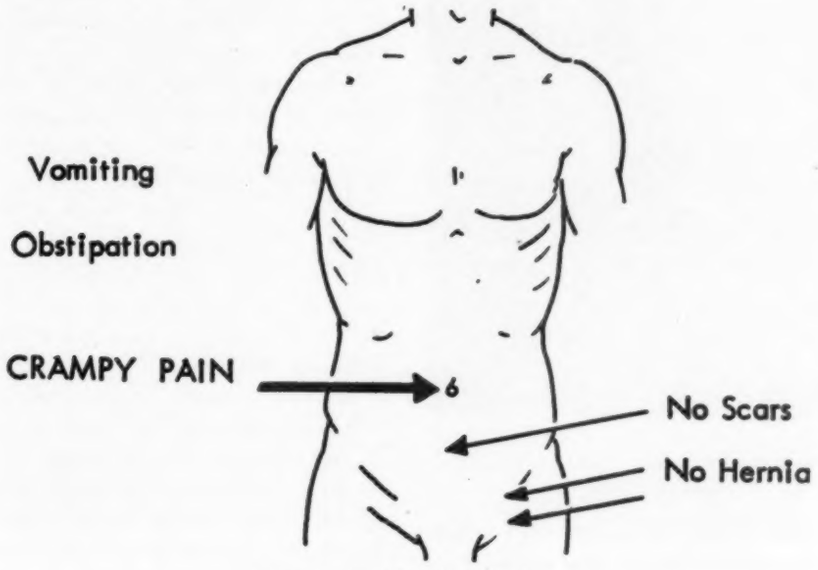

FIG. 3. Diagram of diagnostic features characteristic of gallstone ileus.

Gallstone ileus should be treated by surgery with removal of the gallstones by enterotomy. At surgery the gallstone should be milked from the constricting area and removed through an incision which is then closed transversely. (Fig. 5.) Rarely the stone may be milked through the ileocecal valve, as was done in one case of this series with complete recovery. If the stone is found to be facetted, further exploration of the gastrointestinal tract should be performed to be sure that other obstructing stones are not present.

FIG. 4. X-ray demonstrating gas pattern in liver shadow in association with small bowel obstruction. A diagnostic feature of gallstone ileus.

Twelve of these patients underwent operation, with a mortality of 41 per cent. This rate is high but in reviewing the deaths it reflects mainly the poor physical condition of the patient prior to operation. Since many of these cases go back twenty years it is conceivable that some would be saved with modern preoperative and postoperative care and anesthesia. Three of the patients were not operated upon; one patient passed the stone by rectum, with recovery; the other two patients died.

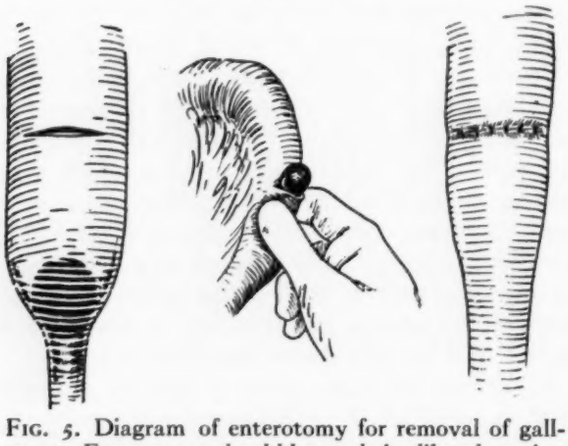

FIG. 5. Diagram of enterotomy for removal of gallstones. Enterotomy should be made in dilated portion of bowel and not at area of impaction where bowel may be necrotic. Enterotomy should be closed transversely to avoid constriction of bowel.

Cholecystoduodenal fistula: Eight fistulas between the gallbladder and duodenum were reviewed. In every case there was a long history of biliary distress and stones were present in the gallbladder at autopsy or at surgery. Four of the patients died from causes other than their biliary disease; one died from carcinoma of the gallbladder; three were treated successfully by surgery.

The usual symptoms of these fistulas are those of an inflammatory process in the right upper quadrant with or without manifestations of choledocholithiasis.

Two of the eight cases were diagnosed by x-ray (Figs. 6 and 7) but the others were found either at the time of gallbladder surgery or at autopsy. This is similar to the series reviewed by Borman and Rigler in which positive x-rays were found in 30 per cent of 267 fistulas.[5]

Correct surgery of this condition depends on the presence or absence of choledocholithiasis. In the absence of this, surgical treatment consists of excision of the gallbladder with closure of the fistula in the duodenum. If there is evidence of choledocholithiasis, the common duct must be cleared of stones. At times the hepatic damage may be so severe that the operations will have to be staged doing first the common duct exploration and later the excision of the gallbladder and fistula.

CHOLECYSTOCOLIC FISTULA

Three internal biliary fistulas involved the colon. One patient with an incidental cholecystocolic fistula died from esophageal cancer; one patient had surgical excision of the gallbladder with repair of the defect in the colon; the third case demonstrated a characteristic error which can be made in this condition. A sixty-five year old woman entered the hospital with a right upper quadrant inflammatory process. A large abscess cavity was incised and drained, but the communication of the gallbladder to the colon was not discovered. Large bowel obstruction developed and cecostomy was performed. The patient's condition became much more critical, and she died two weeks following cecostomy. At autopsy a large abscess cavity was present in the right upper quadrant which communicated with the cholecystocolic fistula. If a defunctioning type of loop colostomy of the ascending colon was performed on this patient instead of a cecostomy, she might have survived.

FIG. 6. X-ray demonstrating barium-filled biliary tree and gallbladder.

FIG. 7. X-ray demonstrating barium-filled biliary tree.

Cholecystocolic fistulas raise several unique problems: (1) The passage of feces through the fistula into the biliary system can lead to a severe cholangitis. (2) If the cystic duct is obstructed, the passage of feces into the gallbladder can result in a severe inflammatory process such as was exhibited in the aforementioned case. (3) Large bowel obstruction may occur. These three factors should make us consider the performance of an ascending loop colostomy as a first stage in treatment to defunction the colon before it enters the fistula. At a later stage the operations for the relief of the fistula such as choledochostomy and excision of the gallbladder with repair of the colonic defect may be done at one operation or in stages. If there is no obstruction, inflammation, or cholangitis, good preoperative care

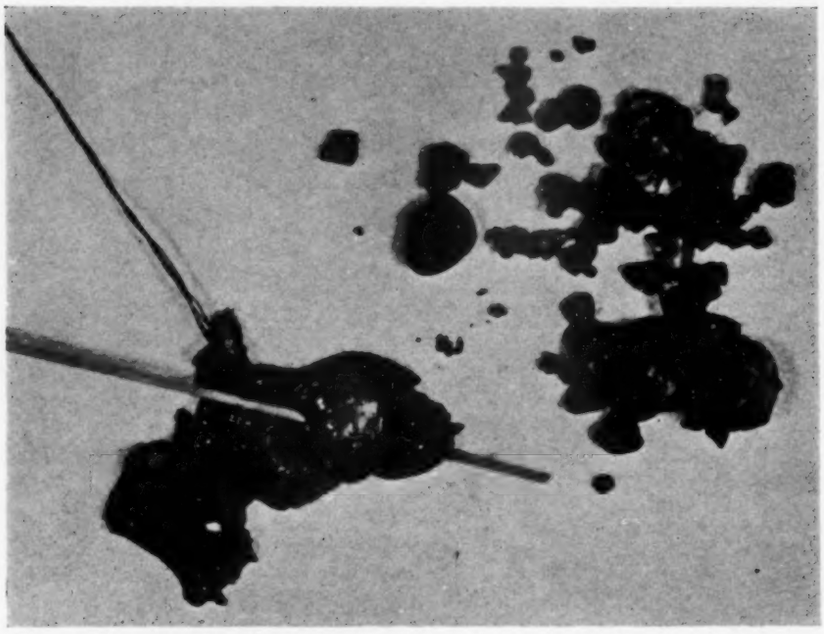

FIG. 8. Photograph of excised gallbladder. Catgut tie is placed on cystic duct. Wooden probe is placed through cholecystocholedochal fistula. The numerous stones found in the gallbladder and common duct may be seen.

of the large bowel followed by gallbladder excision with fistulectomy may be a satisfactory procedure.

CHOLECYSTOGASTRIC FISTULA

One case of a fistula between the gallbladder and the stomach was uncovered. This person had severe right upper quadrant discomfort with jaundice and chills, and died from septicemia. Autopsy revealed a fistula between the gallbladder and stomach with numerous stones in the gallbladder and common duct, and multiple liver abscesses.

The treatment of these fistulas is quite similar to those between the gallbladder and duodenum.

CHOLEDOCHODUODENAL FISTULA

One fistula between a stone-filled common duct and the duodenum was discovered at autopsy. There was no evidence of cholangitis or abscess of the liver.

The treatment of this fistula is quite similar to the ordinary cholecystoduodenal fistula. The gallbladder is removed to prevent further stones from passing down the common duct. The common duct should be explored and all stones removed. The fistula itself requires no operative interference since, with the removal of stones from the common duct, it will heal satisfactorily. It should also be emphasized that in severe cases a staging of the procedures may be necessary.

CHOLECYSTOCHOLEDOCHAL FISTULA

One case of a fistula between the gallbladder and the common duct was found. This patient had severe obstructive jaundice with chills and fever, and was treated by excision of the gallbladder, common duct exploration and removal of common duct stones. (Fig. 8.)

Five similar cases have been reported in the literature, all emphasizing the difficulty encountered in removing such gallbladders with regard to the puzzling anatomy.[6,7]

SUMMARY

1. A review of fifty-two biliary fistulas discovered at the Boston City Hospital over a twenty-year period is reported.

2. Twenty-three external biliary fistulas were studied which represented surgical error in judgment or technic.

3. All the external fistulas were associated with residual biliary disease: gallbladder remnant in eight; stricture, nine; common duct stone, three; biliary intestinal anastomosis, two; cancer of pancreas, one.

4. Thirty internal biliary fistulas were

studied and were found to result from long-standing biliary disease.

5. Sixteen of the internal fistulas caused gallstone ileus. The preoperative diagnostic features of this ileus are discussed.

6. The anatomic types of internal biliary fistula were: cholecystoduodenal, eight; cholecystocolic, three; cholecystogastric, one; choledochoduodenal, one; cholecystocholedochal, one. The correct treatment of each is reviewed.

REFERENCES

1. Lahey, F. H. and Pyrtek, L. J. Experience with the operative management of 280 strictures of the bile ducts. *Surg., Gynec. & Obst.*, 91: 25–56, 1950.
2. Allen, A. W. A method of re-establishing continuity between the bile ducts and the gastrointestinal tract. *Ann. Surg.*, 121: 412–424, 1945.
3. Cole, W. H., Ireneus, C. and Reynolds, J. T. Strictures of the common duct. *Ann. Surg.*, 133: 684–696, 1951.
4. Byrne, J. J. Management of intestinal obstruction. *Boston M. Quart.*, 3: 33–38, 1952.
5. Borman, C. N. and Rigler, L. G. Spontaneous internal biliary fistula and gallstone obstruction. *Surgery*, 1: 349–378, 1937.
6. Behrend, A. and Cullend, M. L. Cholecystocholedochal fistula. *Ann. Surg.*, 132: 297–303, 1950.
7. Patt, H. H. and Koontz, A. R. Cholecystocholedochal fistula. *Ann. Surg.*, 134: 1064–1065, 1951.

Frequently patients with a diaphragmatic hernia also exhibit moderate anemia. Occasionally this anemia is marked. The cause is not known but Pagliardi cites a case in which blood was always demonstrable in the stools. The author therefore surmises that blood loss may be the cause of anemia in these patients. If so, surgical therapy becomes indicated, especially if severe anemia is present, even though the hernia may be small and apparently not causing any trouble to the patient other than this. (*Richard A. Leonardo, M.D.*)

PRIMARY CARCINOMA OF THE VERMIFORM APPENDIX

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THE first unquestionable case of primary carcinoma of the appendix to appear in the literature is credited to Beger, who reported this in 1882.[1,2] However, prior to 1907 when Obendorfer of Germany described and coined the name carcinoid for argentaffin tumors of the appendix, no clear distinction was made between these and the true adenocarcinomas.[3] McWilliams,[4] in a review of the literature in 1908, reported eighty-seven cases to which he added three cases but apparently failed to distinguish between true carcinomas and carcinoids. Klots[5] evidently recognized the more benign character of carcinoid and gave a favorable prognosis to his patient. Selinger,[6] reporting thirty-four cases in 1929, differentiated between those lesions occurring at or near the base of the appendix as being of the columnar cell type and likely to recur, whereas those found near the tip of the appendix were composed of small polygonal or spheroid cells (carcinoid) and were almost always benign. Phillips and Isaac[7] reported a case with widespread abdominal metastases in which the appearance of the tumor suggested a transitional stage between carcinoid and adenocarcinoma. Montgomery and Johnson[8] cited nineteen cases of carcinoid from the literature in which metastases had occurred.

Carcinoids are the most common neoplasms found in the appendix and are most frequent during the third decade whereas true adenocarcinomas occur primarily during the fifth and sixth decade, the latter being the average age for other gastrointestinal carcinomas.[3] Selinger reported thirty-four cancerous lesions of the appendix among 45,302 pathologic specimens of all types. This constitutes 0.075 per cent of all the surgical specimens or 0.35 per cent of all appendices removed. Vance[2] in summarizing a rather extensive review of the literature states, "carcinoma occurs in from 0.2 to 0.5 per cent of all surgical appendices and comprises less than 0.5 per cent of all intestinal carcinomas." Schuldt,[9] reporting a case of malignant mucocele of the appendix, states that of 3,692 appendices removed from January, 1933 to September, 1939, his case was the only primary adenocarcinoma of the appendix found (0.027 per cent of all appendices studied). During this period there were eight cases of carcinoids reported, or 0.216 per cent of all appendices studied.

While carcinoid is much more benign in behavior than is adenocarcinoma, this lesion is not quite so innocuous as one might conclude. Marks and Whitaker[10] quote a series of sixteen cases collected from the literature by Hopping, Docherty and Masson in which malignant changes had occurred in carcinoids of the appendix and add a case of their own which showed extensive metastases involving the right ovary. Thus it would seem advisable that all cases in which carcinoid of the appendix has been found should be followed closely for a considerable number of years for signs of recurrence.

Lesnick and Miller[11] report two cases of adenocarcinoma of the appendix, in one of which only the appendix was removed and the patient had extensive recurrence after two years, involving the cecum, terminal ileum and ascending colon. A second case, treated by appendectomy and resection of a segment of cecum, developed metastatic Krukenberg tumors of the ovaries which were resected nineteen months later. The patient died of generalized carcinomatosis nine months after the second operation. Their conclusion was that radical resection of the terminal ileum, cecum and ascending colon and their mesenteries with a transverse ileocolostomy was the only safe and adequate surgical treatment for this lesion.

CASE REPORT

F. C., a forty-two year old married female, was admitted to the hospital on September 20, 1951 complaining of backache, generalized pelvic soreness and a sensation of weight and loss of support in the pelvis. These symptoms had come on gradually over the previous eighteen months. For three months prior to admission she had been under treatment with mild

sedation, frequent long hot douches, sitz baths and analgesics. This had given some relief from the pelvic soreness but had not relieved the backache nor the sensation of loss of pelvic support. Several attempts to fit her with a satisfactory pessary had given temporary relief from the backache, but she had been unable to wear the pessary for more than a few days at a time because it aggravated the pelvic soreness. Her symptoms had recently become so marked that she was losing considerable time from her work and surgery was advised.

Physical examination showed a well developed, slightly obese white female whose only significant physical findings were a slightly gaping vaginal introitus with second degree rectocele, a retroverted and partially prolapsed uterus which was very tender and a cervix showing mild erosion and endocervicitis with moderate mucopurulent discharge. There were no palpable abdominal or pelvic masses or significant areas of abdominal tenderness. Family history was negative for cancer and menstrual history was without significant abnormality. She had had no pregnancies.

Operation was performed on September 21, 1951, under cyclopropane and nitrous oxide. Operative findings showed second degree rectocele; the uterus was in extreme third degree retroversion, lying deep in the cul-de-sac, with one small fibroid present on its posterior surface. The tubes and ovaries were normal. A few adhesions were present at the fundus of the gallbladder, the wall of which was thin and there were no stones present. Stomach and bowel were normal. The appendix was unusually large and long, with thickening of the wall of the proximal third and some enlargement of the distal third but there was no evidence of inflammatory reaction present.

Perineorrhaphy and repair of the rectocele was first carried out. Next, through a lower midline abdominal incision, a panhysterectomy was done, the vaginal vault closed and the stumps of the round, broad and uterosacral ligaments sutured to the closed vaginal vault. All raw surfaces were then peritonealized by suturing the bladder flap to the posterior vaginal wall and the upper surface of the united uterosacral ligaments. The appendix was removed by division of the base between clamps as close to the cecum as possible, the appendiceal stump being inverted in a silk purse-string suture without ligation. The abdomen was closed in layers without drainage.

The pathologic report showed the specimen to be the uterus, appendix and left tube from a forty-two year old white woman with a diagnosis of rectocele and third degree retroversion with first degree prolapse. The uterus measured 9.5 by 6 by 4.5 cm. The external os appeared slightly stenotic. The exocervix was smooth and glistening as was the serosal. The uterus in semi-fixed condition weighed 120 gm and the endometrial cavity was well formed. The endometrium was velvety pale and measured 4 mm. in thickness. The cervical canal was patent throughout. Several cysts of Naboth were noted. A single subserosal leiomyoma measuring 6 mm. in diameter was noted. The fallopian tube measured 4 cm. in length and 3 to 4 mm. in diameter. It was slightly hemorrhagic externally but soft and pliable. Cut sections were unremarkable.

The appendix measured 12 cm. in length and up to 1.4 cm. in diameter. The serosal surface was relatively smooth and glistening. The vessels were not abnormally prominent. The mucosa of the proximal portion was markedly thickened causing almost complete obliteration of the lumen. The distal portion was unremarkable, the lumen being empty.

Microscopic examination revealed the endometrial glands to show beginning tortuosity and the stroma to show moderate swelling of its cells. The myometrium, exclusive of the nodular tumor, was not remarkable. The fibrotic nodule was composed of whorls and strands of smooth muscle and fibrous tissue. It showed no unusual cytologic features. The cervix showed moderate hyperplasia of the glandular epithelium but no evidence of malignancy. The fallopian tube was not remarkable. Section of the proximal end of the appendix showed the presence of a papillary glandular neoplasm which is consistent with a low-grade adenocarcinoma. In the section studied, it did not appear to be invading the wall, but the pattern of the papillary growth along with the cell type was characteristic of malignancy. (Figs. 1 and 2.) The distal portion of the appendix showed marked dilatation, probably due to the obstruction caused in the proximal portion by the neoplasm. The diagnosis was fibromyoma of the uterus and adenocarcinoma of the appendix, grade 1 to 2; therefore, a second operation was advised.

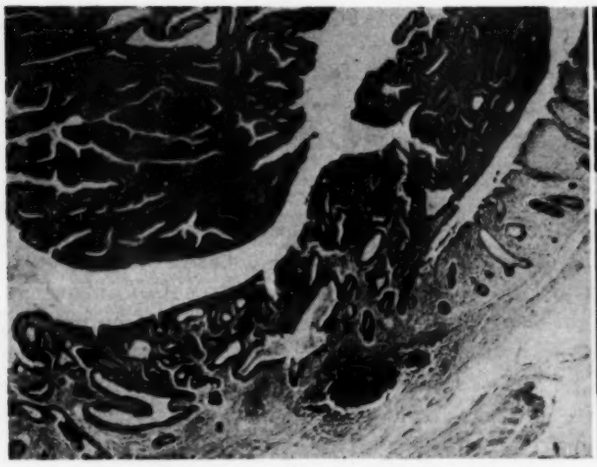

FIG. 1. Low power view showing papillary character of neoplasm without invasion of the underlying wall. The tumor is well differentiated.

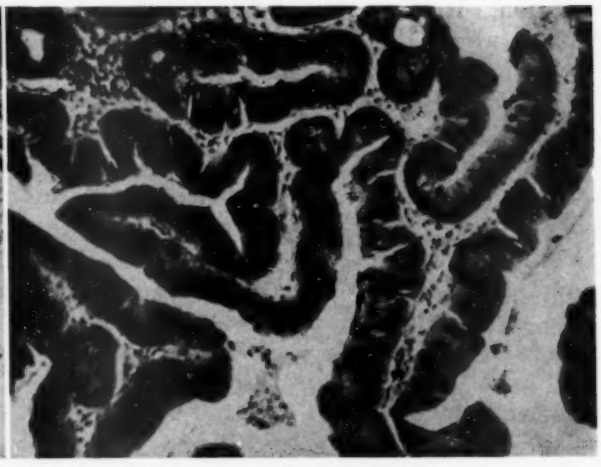

FIG. 2. High power study of glandular neoplastic elements in the papillary neoplasm. Note the large atypical hyperchromatic nuclear forms.

From the time of her discharge from the hospital on September 26, 1951 until her readmission on November 6, 1951 the patient's course was uneventful. She reported a steady gain in strength and relief from her previous symptoms of backache and pelvic distress. The patient was placed on sulfasuxidine, gr. 22.5 every four hours for six days prior to her second operation.

Cyclopropane, nitrous oxide and sodium pentothal were used. Operative findings showed the area of cecum surrounding the inverted appendiceal stump to be indurated and firm. There were no palpable glands in the mesentery and no evidence of metastases in the liver. Through a right rectus incision, the peritoneum was divided laterally to the cecum and this division was extended around the lower end of the cecum and medially about six inches toward the midline from the ileocecal valve. The mesentery of the small intestine was split at this point, Carmault clamps were applied diagonally to the ileum and the ileum was divided. The cecum, ascending colon and hepatic flexure were next mobilized by careful dissection from the underlying structures. The peritoneum was then divided on the mesial side of the cecum and ascending colon, the vessels being doubly ligated and divided between ligatures. The transverse colon was then divided between Carmault clamps at the junction of the proximal and middle thirds. The distal end of the transverse colon was closed; the ileum was then brought up and an end-to-side ileocolostomy was done. All openings in the mesentery were then closed and the abdomen closed in layers without drainage.

Pathologically, the specimen was identified as a possible carcinoma of the cecum. It had been removed from a patient aged forty-three years. This specimen consisted of a segment of terminal ileum, cecum and ascending colon. The section of ileum was approximately 10 cm. in length and the large intestine segment measured approximately 12 cm. in length. There was no appendix recognized with the specimen. At the base of the cecum there was an area of induration. On opening the specimen no ulceration of the mucosa was seen. The induration at the base of the cecum was seen to correspond to a small polypoid portion which protruded into the lumen of the cecum. On cut section through this area a small amount of granulation tissue formation in the wall of the cecum was exposed beneath the mucosa. Here the cecal wall was thickened and this had turned the mucosa up into a polypoid appearance. This polypoid area was approximately 1.5 cm. in greatest diameter, while the small lesion in the wall of the cecum was only about 3 mm. in greatest diameter.

Microscopic examination of the nodule in the cecum showed the mucosal surface over the area to be free of ulceration or evidence of malignancy. The lesion in the wall of the cecum was a foreign body reaction which involved the muscular and serosal coats. Here suture material was seen in the center of three separate areas of microabscess formation. The material was associated with considerable

exudate, all varieties of inflammatory cells and large, multinucleated foreign body giant cells. There was no evidence of malignancy. Pathologic diagnosis indicated a foreign body inflammatory reaction in the wall of the cecum.

The patient's postoperative course in the hospital was without complications and she was discharged on the ninth postoperative day. X-ray check-up three months after surgery showed the ileocolostomy to be functioning well and the patient had no complaints.

SUMMARY

1. In neoplasms of the appendix the correct diagnosis is practically never made preoperatively.

2. The most frequent preoperative diagnosis is acute appendicitis.

3. Most diagnoses are made by microscopic examination of appendices which have been removed incidentally during surgery for other conditions in the abdomen.

4. Carcinoid of the appendix is about ten times as frequent as adenocarcinoma.

5. Carcinoid more commonly appears as a bulbous swelling involving the distal third of the appendix, while adenocarcinoma is more prone to involve the proximal third and to appear as a diffuse thickening of the appendiceal wall.

6. Carcinoma of the appendix occurs in from 0.2 to 0.5 per cent of all surgical appendices and comprises less than 0.5 per cent of all intestinal carcinomas.

7. True adenocarcinoma of the appendix shares with carcinoma of the cecum characteristics of slow growth, involvement by direct extension and late metastases, tending to involve the mesoappendix and the glands about the ileocecal valve.

CONCLUSIONS

1. All appendices removed surgically should be examined by microscopic section.

2. In the presence of any tumor of the appendix it is wise to remove all of the mesoappendix along with the appendix.

3. All cases of carcinoid of the appendix should be followed up by examinations for a period of years postoperatively.

4. Proper and adequate treatment for adenocarcinoma of the appendix should include resection of the terminal ileum, cecum and ascending colon and their mesenteries, with a transverse ileocolostomy.

REFERENCES

1. Lee, G. Q. and Blain, J. H. Adenocarcinoma and carcinoid of the appendix. *J. Internat. Coll. Surg.*, 13: 197, 1950.
2. Vance, C. A. Primary carcinoma of the vermiform appendix. *A. J. Surg.*, 24: 854, 1934.
3. Leonardo, R. A. Primary carcinoma of the appendix versus carcinoid. *Am. J. Surg.*, 22: 290, 1933.
4. McWilliams, C. A. Carcinoma of the vermiform appendix. *Am. J. M. Sc.*, 135: 1908.
5. Klots, T. S. So-called primary carcinoma of the appendix. *Geneesk. gids*, 7: 633, 1929.
6. Selinger, J. Primary carcinoma of the vermiform appendix. *Ann. Surg.*, 89: 276–281, 1929.
7. Phillips, E. W. and Isaac, D. H. Primary carcinoma of the appendix. *Brit. M. J.*, 1: 1127, 1930.
8. Montgomery, J. C. and Johnson, E. T. Primary carcinoma and carcinoid of the appendix. *Missouri State M. A.*, 28: 215, 1931.
9. Schuldt, F. C. Primary adenocarcinoma of the appendix and carcinoid tumors. *Minnesota Med.*, 23: 791, 1940.
10. Marks, E. S. and Whitaker, H. W., Jr. Primary adenocarcinoma of the appendix. *Surgery*, 27: 720–725, 1950.
11. Lesnick, G. and Miller, D. Adenocarcinoma of the appendix. *Cancer*, 2: 18–24, 1949.
12. Jackson, A. S. Carcinoma of the appendix. *Arch. Surg.*, 6: 653–660, 1923.

GLOMUS TUMOR*

A REPORT OF TWO CASES

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THE glomus tumor was first described in 1812 by William Wood of England, who called it a "painful subcutaneous tubercle."[1,2] In 1862 Sucquet[3] demonstrated a specialized arteriovenous anastomosis which acted as a shunt between superficial terminal arterioles and venules which appeared to be larger than ordinary capillaries and which opened directly into the neighboring veins without forming a capillary network. Hoyer[4] verified these findings in 1877 and this specialized structure became known as the Sucquet-Hoyer anastomosis and Sucquet-Hoyer canals. Grosser in 1902[5] also described these structures in detail and brought out the interesting fact that they are poorly developed in the young and in the aged, and are not present in reptiles and other poikilothermic animals. The true etiology of the glomus tumor, however, was not recognized until 1924 when Masson,[6] by histologic studies, showed that this tumor was merely a hypertrophy of one of the normal specialized arteriovenous anastomoses. Because of their resemblance to the glands of Luschka or the glomus coccygeum Masson named these small subungual tumors, which were benign in structure yet caused much pain, glomic tumors. Other names that have been given to this tumor are subcutaneous painful tubercle, glomangioma, angiomyoneuroma and neuromyo-arterial glomus.

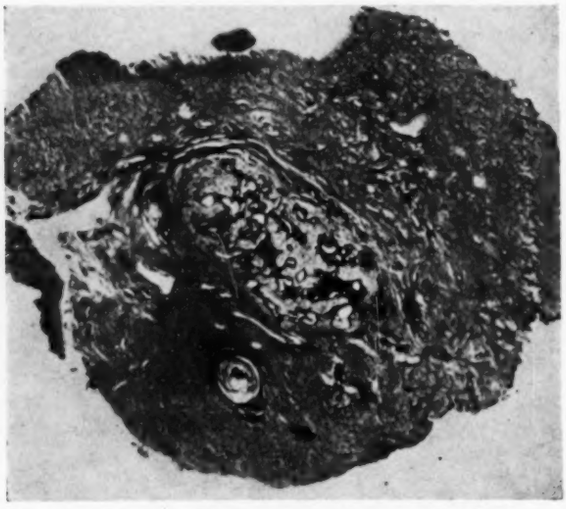

FIG. 1. Case 1. Note small circumscribed tumor located in subepithelial connective tissue. (Low magnification.)

Anatomy. The normal glomus is composed of minute arterioles and venules.[6,7] The arterioles are surrounded by concentrically arranged venules into which they empty. An afferent arteriole, arising from a branch of a subcutaneous vessel, becomes transformed into an S-shaped, twisting, arteriovenous anastomosis with thick, multilayered walls, narrow lumen and absent internal elastic lamina. The anastomosis then empties into thin-walled primary collecting veins. In the loose collagenous reticulum of the outer zone of the arteriovenous anastomosis are nonmedullated nerve fibers. From the primary collecting veins the blood is carried into subpapillary and then into deeper veins.

The glomus is present in the stratum reticulare of the cutis or, in rare instances, in the subcutaneous tissue. The ventral surface of the hand and foot—the ventral and lateral parts of the digits, the nail bed, the nail matrix, the thenar and hypothenar eminences of the hand, and the sole of the foot near the heel—are the most common sites of this tumor.

Physiology. Popoff has pointed out[7] that the normal digital glomus has a twofold function, one local and the other general. Locally, the glomus helps to raise the temperature of the digits when they are exposed to cold by diverting blood from the capillaries through the patent arteriovenous anastomoses into collecting veins with a large surface area. Generally, the glomic system helps to regulate the body temperature. When wide open the glomic apparatus provides for heat loss by

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allowing a large volume of blood to pass through the digits and vice versa.

Pathology. The tumor differs from the normal glomus in the enormous development of its vessels and in the abundance of epithelioid cells and nerve fibrils.[8] It may or may not have a definite capsule.[6] At an early stage no capsule may be present, but later one forms as a result of centrifugal compression.[8] Grossly the tumor forms a soft, pink, fleshy, well defined, usually elongated mass varying in diameter from 1 to 5 mm. and in length from 3 to 12 mm. It may lie partly or wholly within the cutis vera or in the subcutaneous tissue.

Distribution. Of thirty-four glomus tumors collected by Mason and Weil,[9] twenty-one were located on the upper extremity, one over the acromion and eleven on the lower extremity. In one instance the location was not given. Of the twenty-one involving the upper extremity, fourteen were subungual. Of the eleven on the lower extremity, six were on the thigh, three on the leg, one under the nail of the first toe and one on the sole of the foot.

They occur with equal frequency in males and females between the ages of eighteen and eighty-two, the average age being about fifty.

Symptoms. Pain is the outstanding symptom of this tumor. Intermittent at first, it tends to become more constant and excruciating. This is especially true if the tumor is under the nail bed where it is caught in the small unyielding space between the bone of the terminal phalanx and the nail. The pain may be precipitated by the slightest pressure or by a change in the temperature, and may be sharp, burning or throbbing in character, or as one of our patients described it, "all types of pain under the sun." Often, the pain comes on for no apparent reason. When the tumors occur in the digits, they are frequently associated with sympathetic nervous system manifestations.[10] The entire involved extremity may be distinctly warmer than the normal side. A unilateral Horner's syndrome has been reported during paroxysms of pain.[6] In cases of long duration atrophic changes may be demonstrable in the involved extremity. This may be due to disuse. The tumor may involve bone, especially the terminal phalanges of the hand.

Signs. If the tumor is superficial, it appears as a small, well defined pinkish to bluish area measuring 1 to 5 mm. by 3 to 12 mm. in length. When not under the nail it is soft and compressible, and pain may be precipitated by pressure. When the tumor is located subungually, the nail may be raised slightly in the region of the tumor but the nail itself is never eroded.

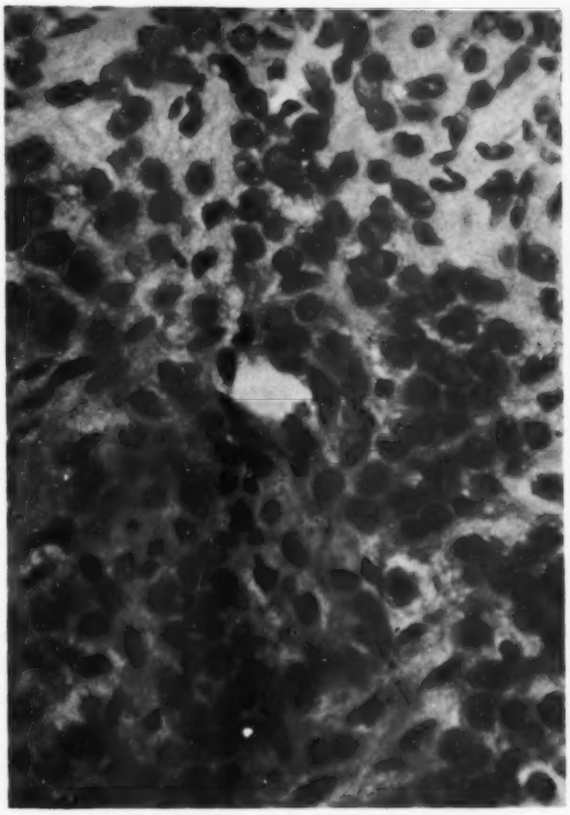

FIG. 2. Case 1. Note glomus cells in outer walls of blood vessels and connective tissue. (High magnification.)

Diagnosis. A glomus tumor must be differentiated from endothelioma, angiosarcoma, cavernous angioma, malignant melanoma and subungual exostosis. The x-ray will, of course, differentiate an exostosis from a soft tissue tumor. Excision biopsy is the most accurate means of diagnosis.

Treatment. The treatment of choice is surgical excision. When located subungually, the nail should be removed so that the operator will have a larger field in which to work. The tumors are not always encapsulated and a small area of normal tissue should be removed with the tumor to assure complete excision. Surgical excision is followed by relief of symptoms and cure in all cases.

CASE REPORTS

CASE 1. A fifty-two year old white woman complained of pain in the left ring finger. She said that for two years the nail of that finger

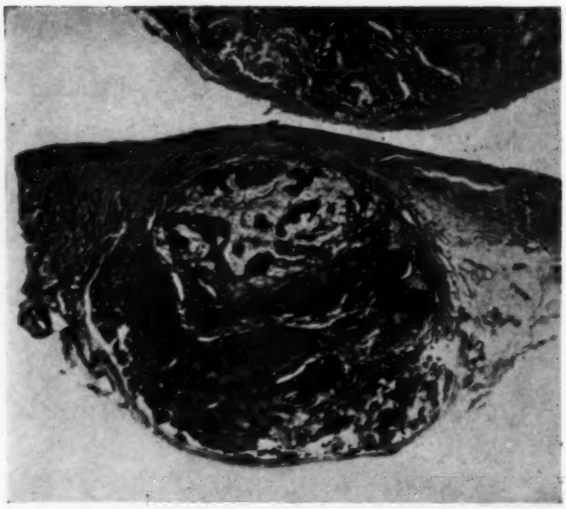

FIG. 3. Case II. Circumscribed tumor in subepithelial tissue composed of small blood vessels and large sheets of glomus cells. (Low magnification.)

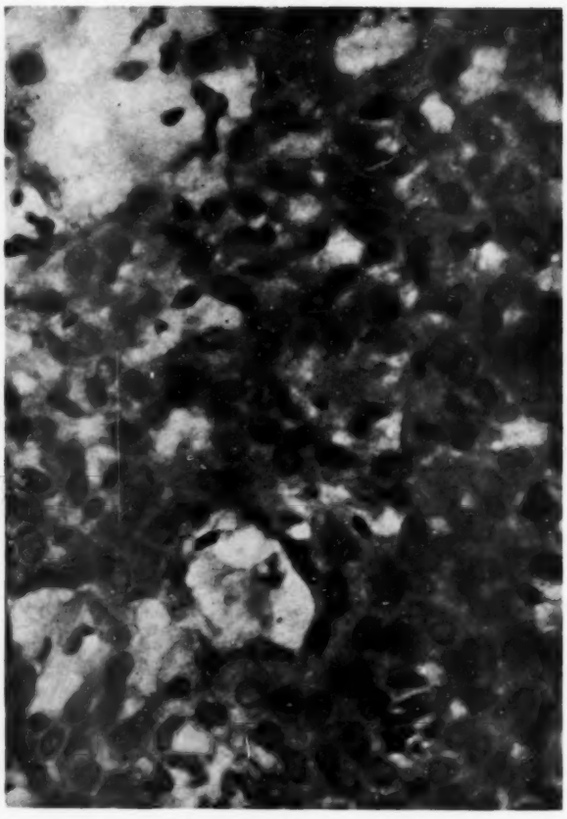

FIG. 4. Case II. Showing glomus cells in outer walls of blood vessels and connective tissue. (High magnification.)

had been very sensitive during manicures or when she accidentally struck it. She had not been able to wear a glove on the affected hand because the pressure caused an almost constant throbbing pain. About six months before she consulted us the finger had become even more sensitive, the slightest jarring or exposure to cold causing pain. She described the pain as "all types under the sun" but mostly throbbing. It radiated into the hand and forearm. The patient constantly guarded and steadied her hand to prevent injury and jarring. About one year previously she had noticed a bluish area in the nail bed of the affected finger and had consulted several physicians. They had told her they could find no cause for her pain and had assumed that she was psychoneurotic.

Positive physical findings were limited to the left fourth finger. Beneath the nail of this finger there was a small bluish to purple circular discoloration, approximately 1 mm. in diameter, which was sensitive to point pressure, the pain radiating up the finger to the hand and forearm. X-ray studies were negative for subungual exostosis. It was our impression that this was a subungual glomus tumor.

When the nail was removed after local nerve block, a small bluish tumor was seen. It was excised together with a margin of normal tissue about it. The pathologist confirmed the diagnosis of a benign glomus tumor. (Figs. 1 and 2.)

Following the excision the patient was symptom-free, and when last seen three years later, there had been no recurrence.

CASE II. A thirty-nine year old white woman complained that she had had pain in the right ring finger for about four years and that it was becoming progressively worse. She described the pain as sharp and throbbing. Sometimes it was precipitated by exposure to cold and at other times it began spontaneously. Slight pressure on the base of the nail caused severe pain followed by aching which lasted for several minutes. During the previous week there had been a throbbing pain along the anteromedial aspect of the forearm and lower half of the arm.

The positive physical findings were limited to the right ring finger, which revealed a questionable fullness on the ulnar side of the eponychium and a small bluish spot in the same area. Pressure on the discolored spot definitely reproduced the pain of which the patient complained. There was no change in the temperature of the fingers. The blood

pressure was 120/80 in each arm. The radial pulse was 68 per minute at both wrists. There was no x-ray evidence of a cervical rib or of subungual exostosis. It was thought that this was a glomus tumor.

After local nerve block the nail of the right fourth finger was removed and a tiny purplish tumor, approximately 1 mm. in diameter, was visible in the matrix. The entire matrix was excised. The pathologist reported that the specimen was a benign glomus tumor. (Figs. 3 and 4.)

Following excision the patient was completely relieved of her symptoms. When last seen six years after the operation she had had no recurrence.

CONCLUSIONS

A glomus is a specialized arteriovenous anastomosis, an end organ apparatus which functions without an intermediate capillary bed. A glomic tumor is merely a benign hypertrophy of this structure. However, because of its size and location, the glomic tumor produces pain which may be excruciating. The two cases described herein illustrate the extreme discomfort that such tumors cause and the prompt relief afforded by excision.

REFERENCES

1. Wood, W. On painful subcutaneous tubercle. *Edinburgh M. & S. J.*, 8: 283–291, 1812.
2. Wood, W. Further observations on painful subcutaneous tubercle. *Edinburgh M. & S. J.*, 8: 429–435, 1812.
3. Sucquet, J. P. Anatomie et Physiologie. Circulation du Sang. D'une Circulation Derivative dans les Membres et dans la Tete chez L'homme. Paris, 1862. A. Delahaye.
4. Hoyer, H. Ueber unmittelbare Einmündung kleinster Arterien in Gefässäste venösen Charakters. *Arch. f. mikr. Anat.*, 13: 603, 1877.
5. Grosser, O. Ueber arterio-venöse Anastomosen an den Extremitätsenden, beim Menschen und den krallentragenden Säugetieren. *Arch. f. mikr. Anat.*, 60: 191–216, 1902.
6. Masson, P. Le glomus neuromyo-arteriel des regions tactiles et ses tumeurs. *Lyon chir.*, 21: 257–280, 1924.
7. Popoff, N. W. The digital vascular system, with reference to the state of glomus in inflammation, arteriosclerotic gangrene, diabetic gangrene, thrombo-angiitis obliterans and supernumerary digits in man. *Arch. Path.*, 18: 295–330, 1934.
8. Greig, D. M. Subcutaneous glomal tumors; painful subcutaneous nodule. *Edinburgh M. J.*, 35: 565–582, 1928.
9. Mason, M. L. and Weil, A. Tumor of subcutaneous glomus. *Surg., Gynec. & Obst.*, 58: 807–816, 1934.
10. Pack, G. T. Tumors of the Hands and Feet. St. Louis, 1939. C. V. Mosby Co.

WIRE SUTURES AND LIGATURES

POINTS IN TECHNIC

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ALLEGHENY stainless steel wire,* first employed by Babcock in 1928, is a valuable suture and ligature material for hernia repair and wound closure. Its limitations are mainly technical and can be overcome by proper handling.

The same principles govern the use of fine wire and fine silk. These have been worked out for us by the masters of suture technic, Halsted[1] and Babcock,[2] whose papers summarize fifty years of suture experience.

Certain minor points in technic facilitate the handling of fine wire: (1) use short 14 inch precut strands which can be handled without kinking; (2) double thread the needle to reduce tissue drag at the needle eye; (3) make ties across the finger tips of the left hand with the needle holder; (4) place stitches with the assistant holding the tissues ahead of the needle; and (5) learn to use the finer sizes of wire.

Pre-cut strands are a great convenience. These may be put up in bundles wrapped with wire, in glass tubing (¼ by 14 inches), in metal dispensers,[3] or in paper sheaths. We employ the latter. Bundles of three to ten strands are formed by unspooling the wire around tacks set 18 inches apart in a board. To form the sheath a strip of paper 2½ by 14 inches is folded lengthwise four times and slipped in place around the strands from the side. The wires are cut loose at the tacks and the sheath is doubled upon itself twice to make a neat 4 inch packet. The exposed wire ends are covered by a slip-off jacket. In special packets the strands are armed with needles. For sterilization and storage the packets can be put up in glass jars, glass tubes or metal foil envelopes.

When the standard needle is twist threaded, the loop tends to work to the side and to cause tissue drag, if not kept under tension. This occurs because the tip behind the eye is broader than the arms of the eye. Much less drag occurs if the strand is threaded through the eye a second time and is pulled down tightly around one side of the eye and left untwisted. (Fig. 1.)

Special needles have been designed for wire. Lister's double-eyed needle goes back to the days of silver wire. The spring or calyx eye needle, with the bridge between the eyes uncut, is quite serviceable for wire. The Duff-Allen (1934) modification has the front eye uncut and the back eye open. Schulte and Lyons,[4] and Rosemond[5] have described needles using this principle. We favor the Babcock needle (1934) which is a standard needle with the tip squared, V'd, and the side grooves deepened. The wire should be pinch threaded with the smaller sized needles. The pinched point is pulled back into the tip of the needle.

Wire sutures are available attached to the eyeless non-traumatic tubular head needle. These are ideal, especially in the very fine sizes. With the utility size needle the surgeon can attach the strands himself, using a modified "cut nipper," a pincer type hand tool. These needles can be made rethreadable for wire by fitting them with a silk loop. The wire is pinched before threading, and this point grips the loop securely. The regular catgut needle can be fitted with such a loop as well. Another useful device is the long loop suture carrier, used for silver wire and catgut in the time of Howard Kelley, before the tubular head needle. The short loop may be used with small needles and fine wire as in a hernia repair, while the suture carrier is used with larger needles and stiffer wire as in the through and through abdominal closure, and for the intracutaneous pull-out stitch.

Any needle in which the tip behind the eye is no wider than the sides will be satisfactory for wire. Examples are millinery needles which are used for stick ties, and the flat Hagedorn

* Almet 316—chrome 18 per cent, nickel 8 per cent, molybdenum 2 per cent—manufactured by Alloy Metal Wire Co., Prospect Park, Pa.

needle which is used for the intracutaneous pull-out stitch as recommended by Halsted.[1]

The Singer and the Vim-Ogburn stitching instruments[6] work very well with fine wire. The wire is ready for use in the instrument, with no bother to thread a needle or measure out a strand. The instruments are found convenient by the surgeon who closes the fascia with interrupted wire but uses another material on the peritoneum and skin.

Wire is available in braided strands of multiple fine filaments and as wire cloth. The braided strand is more flexible than a solid one of equal gage and is preferred where a heavy strand is needed. In the finer gages we prefer the solid strand. The wire cloth is used by Babcock[7] in the repair of tissue defects. Catgut and wire can be combined into a dual strand which, in experimental use, seems to embrace the good qualities of each material.

Fine wire is a superior ligature material. Its stiffness and great strength make it easier to handle and easier to tie than fine silk or cotton. The three finer gages are employed: 36-38-40 gage, .005-.004-.003 inch. Size 40 gage, the finest, looks like a filament from a cobweb, yet it has a breaking strength of 0.85 pound. To facilitate handling these fine strands we arm them with 2½ inch No. 4 millinery needles. To pick up a strand, one picks up the needle. They are prepared with five strands to a packet. A binocular loupe is used in threading the needles.

Tying with wire is very simple, and a few minutes practice on a piece of cloth will aid in developing the technic. We make a free tie as follows: The surgeon holds a packet of the armed strands in his left palm (1) he draws out a needle with the needle holder until he can grasp the strand with the left thumb and index; (2) the assistant cuts the strand behind the needle, which has now served its purpose and is discarded; (3) the surgeon takes the free end with the needle holder and completes the tie.

We make a stick tie as follows: The assistant holds a packet of armed strands in his left palm, (1) he draws out a needle with the right thumb and index and closes his other fingers around the strand; (2) the hemostat to be tied off is picked up with the left finger tips; (3) the needle is passed through the tissues with one smooth motion by moving the finger tips on the needle. When the maneuver is completed, the right hand holds the needle with the thumb and index, and the free end is held in the palm of this same hand by the other fingers. The strand is now in front of the surgeon, on his side of the hemostat, ready for him to complete

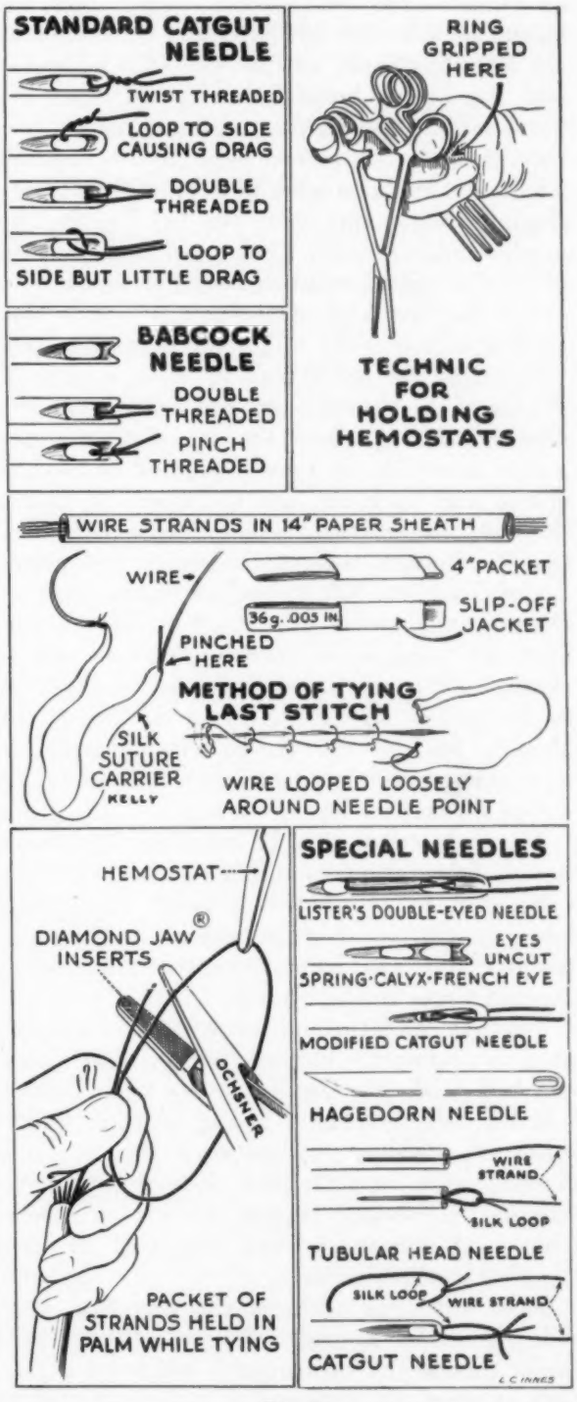

FIG. 1.

the tie. He takes the free end with the needle holder and the needle end with his fingers.

Ties are best made across the finger tips of the left hand with the needle holder or hemo-

stat.[2] The needle holder must have jaws that will grasp the fine wire. We use the ones with diamond jaw® inserts. One technic for tying is as follows: For descriptive clarity, call the strand between the left hand and the hemostat tip, the left strand, and between the hemostat and the needle holder, the right strand. (1) Start with a short right strand, and pass it over the tip of the left second finger and across the left strand at the point where it is held between the left thumb and index tip. (2) Release the needle holder, reach under the left strand, grasp the right strand and pull it through to make the first half of the square knot. This knot is sufficient for minor bleeders. (3) Push forward on the left strand to make a loop off the tip of the thumb. This is possible since the wire is stiff. (4) Pass the tip of the needle holder, carrying the right strand, over the left strand and back through the loop. (5) Grasp the right strand with the left thumb and index tip. (6) Release the needle holder and grasp again above the left strand and pull down to complete the square knot. (7) Cut close on the knot. In tying with fine wire the free end is always held in one's grip and is never dropped to be picked up again, for it is difficult to identify against the tissues. In suturing, a hemostat on the free end keeps it from being pulled through or lost to view.

Minor bleeders can be controlled without ties or fulguration by applying the hemostat vertically[8] to the bleeding point alone and later twisting it off, as was done in the days before Lister. This leaves no suture material or charred tissue in the wound.

Through and through wire sutures can be used in abdominal closure, but in most cases one will wish to close in layers with buried stitches[9] which make a neater closure. Short series of running stitches with the 14 inch strands save much time over interrupted stitches. Robinson[10] starts a running stitch from each corner and ties the final stitches together in the midline.

Since wire has stiffness the first and last stitches can be secured with a loop twist. We prefer this on the skin since it leaves no sharp ends exposed. It is placed as follows: Stitch 1 enters about 1 inch to the right and comes out ½ inch to the left. A hemostat on the free end prevents pulling through. Stitch 2 will make a tie with stitch 1, so it is brought out close to stitch 1. As the needle point comes through on this stitch the strand from stitch 1 is wound loosely twice around the needle point. The needle is pulled through and the loop is pulled down carefully, being guided with the tip of the needle holder inside the loop. Finally the tie is seated by pulling up simultaneously on the strand and on the free end held by the hemostat. Subsequent stitches are placed with the strand held in the left hand and the needle holder in the right. The assistant picks up the tissues ahead of the needle. All stitches are pulled down gently. Any excess slack can be adjusted later by twisting a loop in the wire. The final stitch is secured in the same manner as the first by winding the strand around the needle point. To have this last loop pull down smoothly the needle is passed under the incision again to put the line of pull in the correct direction. The tip of the needle holder inside the loop keeps it straightened. Finally the free ends are cut off flush with the skin so that they retract below the surface, with no sharp points to be felt.

On an abdominal incision we like to place two lines of running stitches on the surface. The first line is made with 35 gage .0056 in wire with locked stitches at intervals of 1 inch and back ½ inch from the margin. The second line is a simple running stitch of 35 gage or finer, close to the margin. The first line holds the margins for the second. The first line is removed on the third day leaving the second line intact to be removed a few days later. With longer segments between stitches removal is easier. Removal is remarkably painless. Fine pointed iris scissors and a binocular loupe are useful in the removal.

We dress the wound on the second day and leave it uncovered. This permits general bathing and the use of dry or moist heat on the wound to relieve soreness. An uncovered hand incision is appreciated since the member can be in and out of water. Wounds in sites rubbed by clothing need to be covered for the friction causes itching.

Size 35 gage .0056 in wire is the easiest to handle technically. This size serves adequately for both suture and ligature[11] in the average surgical wound in which one fulgurates the minor bleeders. This gage cannot be identified under the abdominal skin by palpation and in most sites is invisible in the x-ray.

For minor surgery in the office we use packets of 38 gage .004 in wire containing three strands

each 14 inches in length, one of which is armed with a No. 3 or 4 cutting point eye needle. The packets are sterilized in salad dressing jars in the autoclave. The needle protrudes from the end of the packet so that it dries quickly and does not rust. A single packet will serve as suture and ligature for most minor wounds.

The many special uses for wire sutures are beyond the scope of this paper, the purpose of which is to call attention to fine wire as a utility suture and ligature material for everyday use.

SUMMARY

Fine steel wire is a useful suture and ligature material for everyday surgery if one observes a few minor points in technic. Short 14 inch strands properly threaded correct the kinking and tissue drag. For convenience the strands are pre-cut and packed in paper sheaths.

REFERENCES

1. Halsted, W. S. Ligature and suture material. *J. A. M. A.*, 60: 1119, 1913.
2. Babcock, W. W. Metallic sutures and ligatures. *S. Clin. North America*, 31: 1435, 1947.
3. Dean, G. O. Some surgical and technical aspects in the usage of wire sutures. *South. Surgeon*, 16: 250, 1950.
4. Schulte, T. L. and Lyons, H. M. New method of wire closure of kidney and ureteral incisions. *J. Urol.*, 53: 422, 1945.
5. Rosemond, G. P. New needle for use with wire suture material. *Arch. Surg.*, 63: 58, 1951.
6. Goodman, H. I. A new surgical suturing instrument with a continuously threaded needle. *J. A. M. A.*, 120: 281, 1942.
7. Babcock, W. W. The range of usefulness of commercial stainless steel cloth in general and special forms of surgical practice. *Ann. West. Med. & Surg.*, 6: 15, 1952.
8. Knott, J. I. Method of holding multiple artery clamps. *Am. J. Surg.*, 50: 330, 1940.
9. Jones, T. E., Newell, E. T. and Brubaker, R. E. The use of alloy steel wire in the closure of abdominal wounds. *Surg., Gynec. & Obst.*, 72: 1056, 1941.
10. Robinson, J. R. Closure of abdominal incisions with continuous steel sutures. *Am. J Surg.*, 84: 690, 1952.
11. Wu, Y. K. and Pai, H. C. Fine alloy steel wire sutures. *Surg., Gynec. & Obst.*, 74: 110, 1942.

Modern Operative Technics

No. 15

PLASTIC SURGERY IN RECONSTRUCTING THE PRIMARY CLEFT LIP AND NASAL DEFORMITY*

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THE patient operated upon for cleft lip is often distinguishable by a defect of the lip and the nose. These shortcomings follow a pattern and are the result of both absent and displaced tissue inherited from the original deformity.

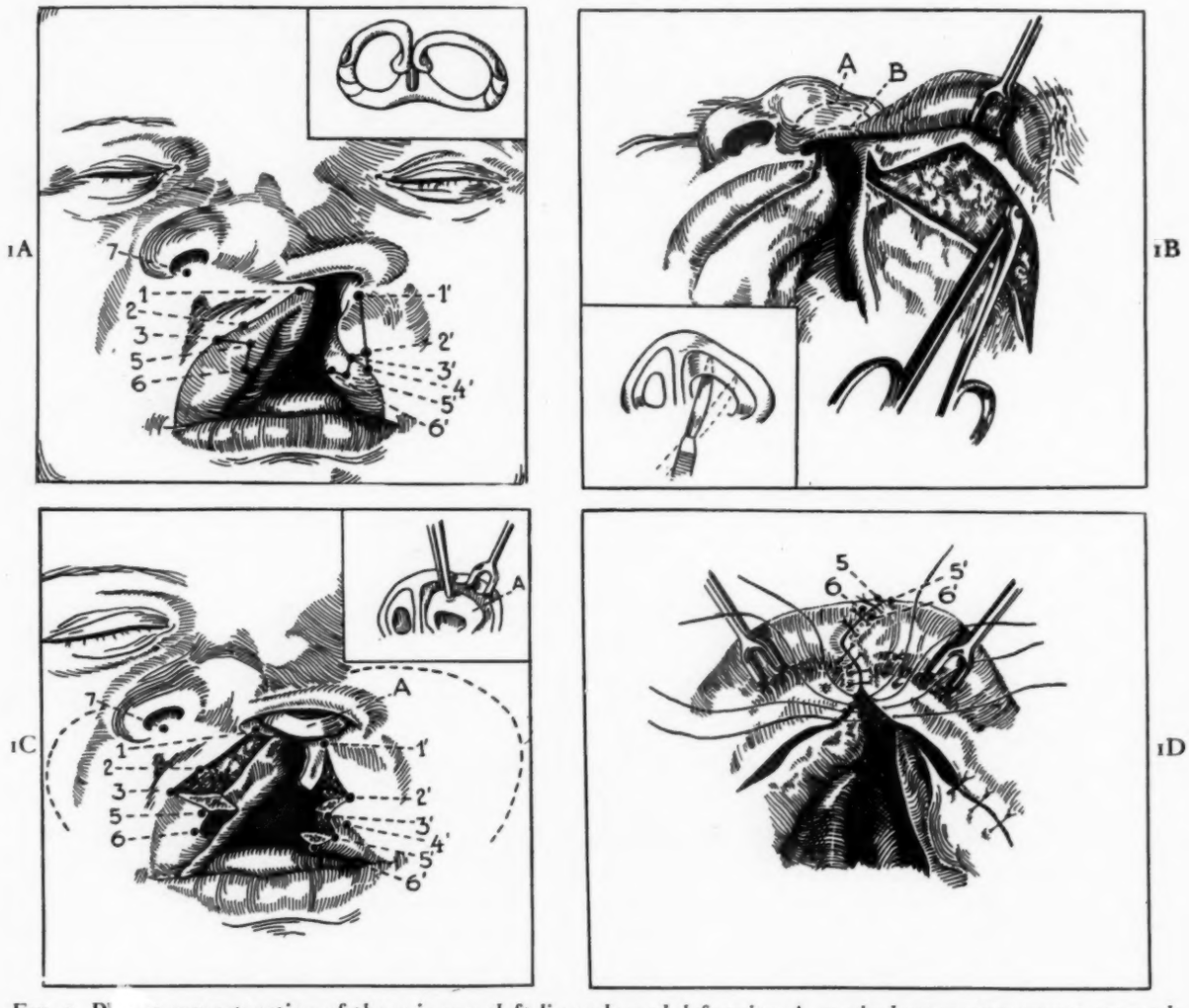

FIG. 1. Plastic reconstruction of the primary cleft lip and nasal deformity. A, meticulous measurements are made to indicate lines of incision. *Inset* shows deformity of nasal lower lateral cartilage. B, incisions are made within external alveolar margins thus undermining cheeks away from maxillary bones on both sides. Resulting relaxation of tissues aids in approximation of lip. *Inset*, incision is made between upper and lower lateral cartilages; another incision is made below the latter resulting in complete freedom of this cartilage. C, minimum requisite amount of tissue has been resected and lip is ready for approximation. Lower lateral cartilage (A) is free. *Inset* again shows freeing of cartilage. D, alveolar margins and vermilion borders of lip are approximated. Predetermined measurements should allow for exact slotting of opposite sides.

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The resultant scar on the lip following surgical repair may be of relative minor importance in this identification as long as there are no cross hatch suture marks. The scar lends itself only to the other more prominent typical defects to create the recognizable facies.

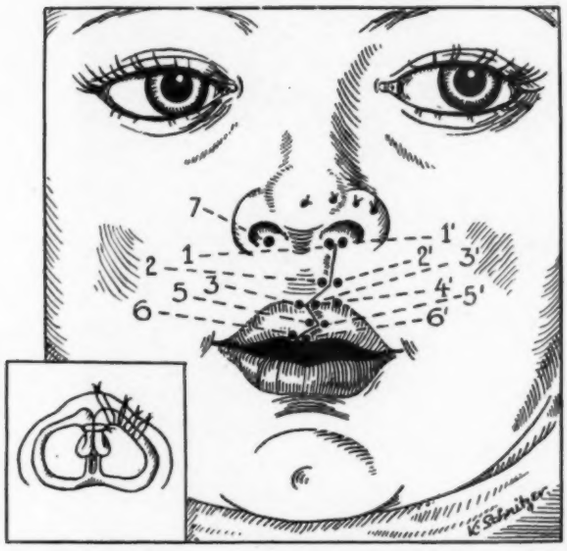


FIG. 1E. Following complete approximation of the lip, the nasal cartilage has been allowed to slide into normal position and there fixed with mattress sutures. *Inset*, normal dome of the nose to be compared with the original deformity. See *inset* in (A).

The lip proper, if not too long, too short nor retruded, is not necessarily a distinguishable feature. Secondary revisions on the lip and vermilion may be satisfactorily employed to gain "normalcy" of measurements and symmetry. Such latent surgical intervention is more gratifying in cases in which there has been a thoughtful primary repair.

The nasal deformity usually carries the most guilt in exposing the repaired cleft lip. The disarranged tissues, with growth, often lend themselves only partially to secondary repair and continue to play their identifying role.

The prime opportunity to gain an optimum functional and cosmetic result is presented to the surgeon at the initial operation. The tissues of the nose and the lip should be so reconstructed as to gain the maximum result with the thought that secondary procedures may be necessary.

THE LIP

An evaluation of the deformities present in the primary lip must be made in order to correct them. These multiple defects are singled out so that their elimination can be accomplished according to a predetermined plan.

I have used various procedures in the correction of a cleft lip. Thus far, I have found the method projected by Brown and McDowell the most satisfactory and elastic. The scope of the deformity and the requirements for repair are the following: (1) reasonable nostril floor, (2) curved attachment of the ala to the face and a symmetrical alar level, (3) straight columella, (4) full upper lip that is advanced over the lower, (5) symmetrical vermilion border and (6) cupid's bow if possible. (Figs. 1 to 3.)

Due to the extent of the deformity, it is not always possible to gain the ideal result at the initial procedure. The thought of secondary correction should guide the surgeon and tissues should not be discarded until all possibility for their future use has been exhausted.

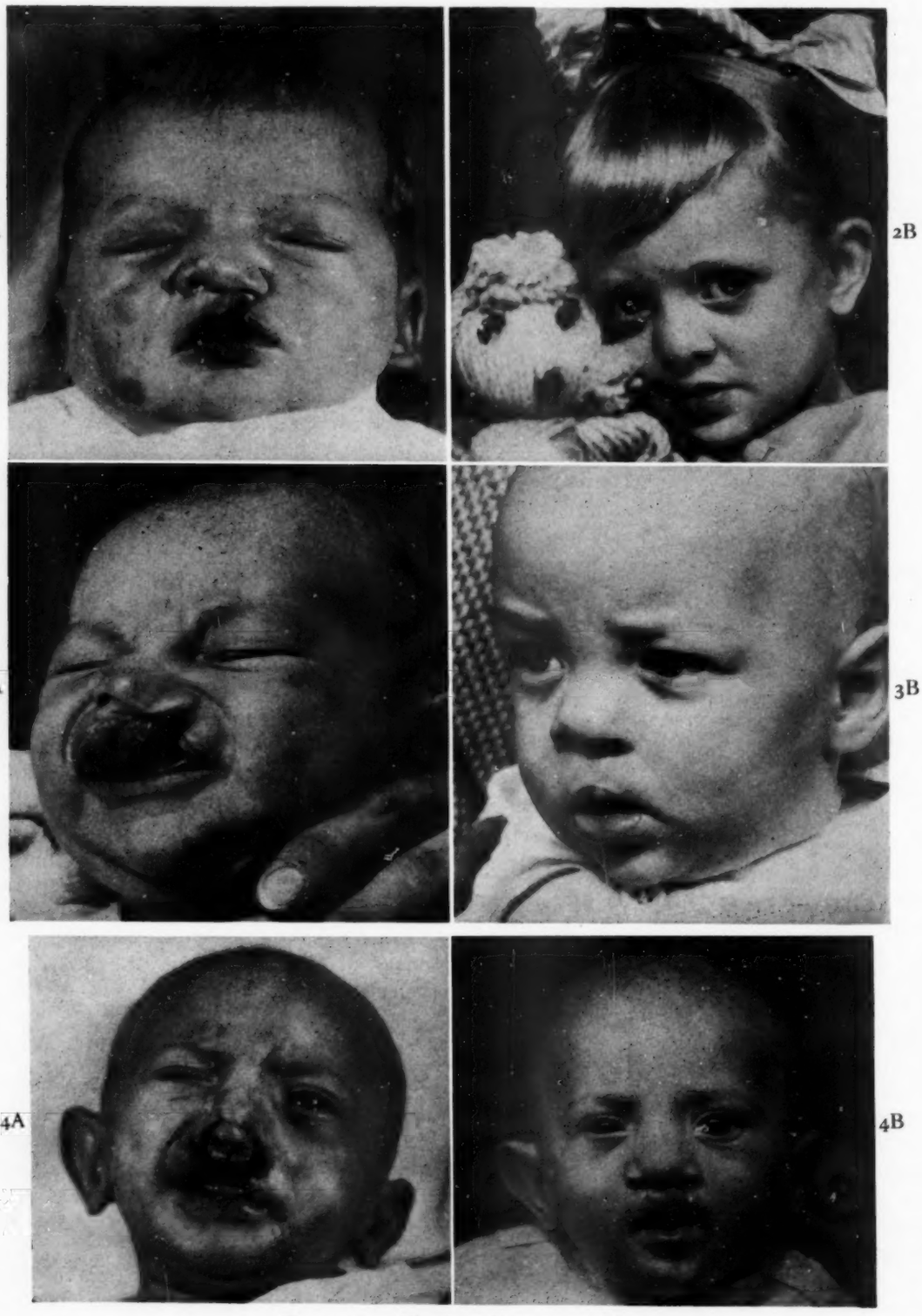
In reconstruction of the lip, closure should be gained without tension by meticulous undermining and employment of relaxing incisions where necessary. The tissues of the lip and the nose must be so revised as to gain maximum function and cosmetic improvement with future growth and development importantly considered in this equation.

Primary closure of the cleft lip is usually carried out during the first few weeks of life. Associated cleft palate deformities are most often repaired sometime after eighteen months of age. The initial closure of the lip will aid in approximating the maxillary bones thus decreasing the size of the hiatus in the palate. Vomer flaps may sometimes be utilized judiciously in the closure on the anterior palate defect.

NASAL DEFORMITY

The cleft lip nasal deformity on the affected side, usually consists of an absence of the nasal floor, deformed flattened ala, deviated columella, flattened dome of the lower lateral cartilage and depressed upper lateral cartilage. An effort must be made to correct these defects at the primary surgery.

In order to obtain relaxation of all tissues and allow them an opportunity to slide into position on their own volition, the lower lateral cartilage is completely freed. On the affected side, an incision is made along the inferior border of the upper lateral cartilage and brought forward separating the septum from the columella for about 5 mm. A second incision is made along the lower border of the lower lateral



FIGS. 2 to 4 (*See legends on page 203*).

5A

5B

6A

6B

FIG. 2. Cleft lip incomplete. A, although the cleft does not enter the floor of the nose, the nostril is flattened. The baby also had a complete cleft palate. B, plastic repair requires reconstruction of both the lip and the nose. This was done at twelve days of age. The palate was repaired when the baby was eighteen months of age.

FIG. 3. Cleft lip complete and cleft palate. A, the nose is deformed and necessitates plastic repair conjointly with repair of the lip. This may be done within the first two weeks of life. The palate may be repaired some time after eighteen months of age. B, restoration of normal lip and nasal contours.

FIG. 4. Double cleft lip and cleft palate. A, the protruding premaxilla, short columella and wide clefts offer special problems. B, following one operation. A rectangular section was resected from the vomer bone allowing the premaxilla to slide backward. The lip and nose were reconstructed. The palate surgery will be done at some later time.

FIG. 5. Cleft lip and partial cleft palate. A, the defect involves the lip as well as alveolar bone and nose. B, several years after one operation.

FIG. 6. Double cleft lip and cleft palate. A, lip is repaired at a single operation while reconstruction of the palate is held in abeyance. The double cleft complicates the problem of repair. B, following plastic surgery.

FIG. 7. Complete cleft lip and cleft palate. A, early repair of the lip aids in approximating the palate. B, following one operation on the lip and one on the palate. Speech is excellent. Cleft palate patients do not "hear" their speech defect, so that early speech training is mandatory.

FIG. 8. Complete cleft lip and cleft palate. A, the nasal deformity is the "give-away" in many cleft lip repairs. Therefore special attention must be made toward reconstructing the nose at the original operation. B, following a single operation on the lip and the nose.

cartilage. The latter is completely undermined and allowed to remain attached only medially and laterally. Subsequently, when the lip and ala are approximated to their required positions, the lower lateral cartilage is returned to its bed to assume a position of normalcy with the aid of several through-and-through mattress sutures. This complete freeing of the lower lateral cartilage tends to overcome the distortion of the nostril. (Fig. 1.)

Secondary revision of the lip and the nose may be necessitated. Such action is timed and performed at the discretion of the surgeon dependent upon several factors, namely, the extent of the defect, the psychologic trauma being induced upon the child and the expected improvement. In some cases the procedure may be done when the child enters grade school, while in others, after they have reached adolescence. (Figs. 4 to 9.)

This procedure, in reconstructing the nose at the time of repairing the primary cleft lip, has been done on eighty-five patients over the past ten years. I believe that the nose with growth (including the size and direction of the nostril, the ala and the floor) appears more normal than in those cases in which this procedure was not used.

9A 9B

FIG. 9. Cleft lip incomplete. A, the deformity virtually always involves the nose as well as the lip. B, following plastic repair.

It has sometimes been assumed that disturbance and/or injury to the cartilage of a child might impede its growth along a normal pathway. In no instance have I noted growth impediment in this series of cases.

SUMMARY

Surgery on the primary cleft lip must include all the principles of plastic repair and an overall plan to allow for growth. Minimal scars and an effort to obtain normal position of the structures is the prime aim to obliterate the cleft lip facies.

An operative procedure to gain optimum improvement of the nasal deformity is presented.

REFERENCES

BROWN, J. B. and MCDOWELL, F. Simplified design for repair of single cleft lips. *Surg., Gynec. & Obst.*, 80: 12–26, 1945.

BROWN, J. B., MCDOWELL, F. and BYARS, L. T. Double clefts of the lip. *Surg., Gynec. & Obst.*, 85: 2–29, 1947.

LAMONT, E. S. Reparative plastic surgery in secondary cleft lip and nasal deformities. *Surg., Gynec. & Obst.*, 80: 322–34, 1945.

Practical Surgical Suggestions

THE USE OF THE CYSTOSCOPIC CLOT ASPIRATOR IN THROMBECTOMY AND EMBOLECTOMY*

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INCISION into large arteries or veins for the removal of thrombi or emboli has become a well recognized surgical procedure. One of the technical difficulties that has not been completely solved is the freeing of adherent clots after opening the vessel. Suction with negative pressure from an electric pump is commonly used, with a glass-aspirating tip. If this does not succeed in sucking out the clots and giving a free flow of blood, Pratt has suggested a smooth modified gallstone clamp or a corkscrew of silver wire to pry the clots loose.

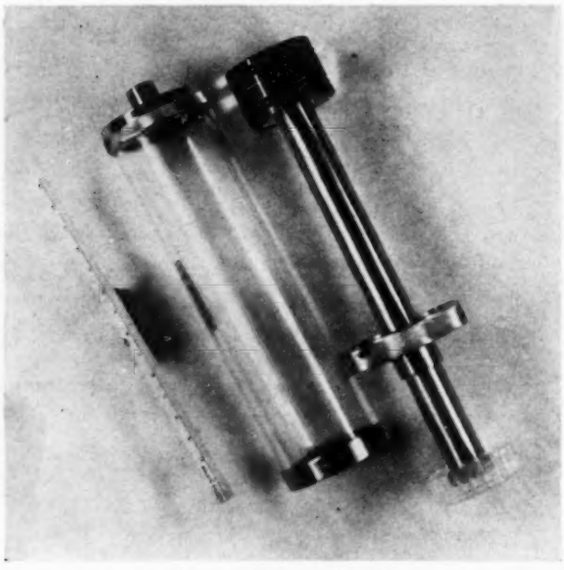

Fig. 1. Clot aspirator.

Since the advent of transurethral resection of the prostate gland urologists have occasionally been confronted with the necessity of evacuating large numbers of clots from the bladder. In the past a cystostomy was occasionally considered necessary in order to remove clots. Now such efficient instruments have been developed that clots of any amount or size are successfully aspirated through the cystoscopic sheath. Instruments to break up the clots have been designed and used in the past in the field of urology, but with the powerful suction syringe now available they are almost never necessary.

This report concerns the successful use of a clot-aspirating syringe used by urologists in a case of extensive thrombosis of the external and common iliac vein after the conventional types of suction and all other maneuvers had failed to clear the vessel. (Fig. 1.)

CASE REPORT

Mrs. L. W., aged thirty-six, entered the hospital January 1, 1951, with an impacted calculus 3 by 7 mm. in the left lower ureter. She had a past history of bilateral renal calculi. She was treated for a total of sixteen days by various cystoscopic maneuvers, including indwelling catheters and a trial of the Johnson stone basket. During this period severe pyelonephritis developed which necessitated the reinsertion of ureteral catheters. While the indwelling catheters were in place, the patient remained on her back or turned on the side, and active and passive movements of the ankles and leg muscles were carried out to prevent possible thrombophlebitis. In spite of these precautions on January 16th she complained of severe cramps in the left leg. Later in the day the entire left leg was very painful. Homans' sign was positive, and there was marked tenderness over the large veins.

At operation on January 17, 1951, (anesthesia pentothal, N_2O_2 and demerol) an oblique

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muscle-splitting incision was made in the left lower quadrant. The external iliac vessels were exposed extraperitoneally. The external iliac and common iliac veins formed a solid cord. The external iliac vein was dissected free and opened by a transverse incision. A few clots oozed out. A glass suction tip was introduced into the proximal portion of the vein and many clots aspirated, but no blood obtained.

The prostate resectoscope sheath, F28 size, was then introduced into the vein and aspiration with the cystoscopic clot syringe was then carried out. With this technic the final clots were readily pulled out and a forceful flow of blood obtained. The vein was then divided and transfixed. Following this procedure the ureteral stone was removed from the pelvic portion of the left ureter. One Penrose drain was placed and the incision closed. Recovery was uneventful. No edema of the leg developed postoperatively.

Comment: In addition to use in veins, the aforementioned efficient suction would seem to be indicated in arterial embolectomy, particularly the saddle embolus. In attacking saddle embolus extraperitoneal approach in the femoral region under local anesthesia has been advocated by some. Either the resectoscope or panendoscope sheaths are sufficiently long to reach the bifurcation from an incision located in the femoral region.* With effective means of clot removal the femoral incision would seem to be preferable to the transperitoneal.

REFERENCE

PRATT, G. H. Surgical Management of Vascular Diseases. Philadelphia, 1949. Lea & Febiger.

* The following sheaths fit the clot-aspirating syringe (American Cystoscope Makers, Inc., New York, N. Y.): woven semi-rigid Crigler Clot Evacuating Catheter furnished in sizes F24, 26 and 28 (C. R. Bard, Inc., Summit, N. J.); straight metal panendoscope sheaths with open end available in sizes F16 to F30 (American Cystoscope Makers, Inc.).

BILATERAL ONE-STAGE ADRENALECTOMY*

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IMPROVED understanding of the normal and deranged physiology of the adrenal glands has led to increase in the frequency with which exploration or resection of them is considered indicated. It is currently apparent that total bilateral adrenalectomy has some palliative value in certain cases of advanced metastatic breast and prostatic cancer. Consequently, general surgeons may expect to be called upon more often to operate upon the adrenals. Such operations have been performed through intercostal (transpleural, transdiaphragmatic), lumbar and abdominal incisions. The last-named approach affords four major advantages over operations by other routes: (1) Both glands may be examined or removed through a single incision and without changing the position of the patient. (2) Abdominal and pelvic exploration may be made a part of the operation, with search for aberrant adrenal tissue, and for tumors arising in that or in other organs derived from the urogenital ridge. (3) The adrenal veins may be ligated and divided without direct manipulation of the glands, and (4) novocain may be injected under direct vision into retroperitoneal spaces in celiac and perirenal areas. The latter maneuver provides complete relaxation with light inhalation anesthesia and avoids untoward stimulating effects of manipulations close to the diaphragm. The technic described has been found to be applicable in the cases of patients with a variety of body builds, even in those with narrow costal angles or with considerable obesity of the abdominal wall. The operation is not easy but may be accomplished safely by general surgeons who habitually perform many which are more difficult. We believe this technic to be the method of choice for exposure or removal of both adrenals and present it in detail because we have been unable to find a description of a comparable one.

Since displacement of important structures in anterior relationship to the adrenals is an essential feature of access to the glands from in front, it is important briefly to review the surgical anatomy involved. The adrenals are enclosed in special compartments of the perirenal fascia (Gerota's capsule) continuous with that surrounding the kidneys. They remain in close approximation to the kidneys as long as ptosis of the latter does not occur. The adrenals differ slightly in their relations and in their shape. The right is pyramidal or conical, capping the highest portion of the anteromedial border of the kidney. Its hilum is overlapped by the right margin of the inferior vena cava, which thus conceals the short, anterior, adrenal vein emptying into its posterior aspect. Unusually this vein may be longer and run downward, even to empty into the right renal. Laterally to the vena cava the first portion of the duodenum overlies the antero-inferior surface of the adrenal; its anterolateral surface is in contact with the right lobe of the liver near the so-called bare area. Thus the right gland may have no contact with peritoneum.

Posteriorly and superiorly each adrenal lies upon the lumbocostal arch and near the corresponding crus of the diaphragm. Although the right gland is slightly more caudad with relation to the posterior abdominal wall, access to it from in front is more difficult than access to the left gland because of the former's position behind the liver and vena cava. The longer, crescent-shaped left adrenal lies more medially to the upper pole of the kidney. Its longer vein courses downward to empty into the left renal vein, and is exposed by division of the posterior peritoneum of the omental bursa which covers the gland anterosuperiorly, and by downward retraction of the tail of the pancreas and splenic vein. Not only is the left adrenal vein easier to expose than the right but it also restricts mobilization of the gland less.

The adrenal arteries are numerous and generally small. They are derived from the aorta and the inferior phrenic and renal arteries and

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enter the glands at their borders. Their number, size and derivation are greatly variable, hence isolation and individual ligations are difficult and unnecessary.

Inhalation anesthesia is supplemented by infiltration of 0.5 per cent novocain along costal margins, beneath diaphragmatic peritoneum and around the celiac axis and the superior poles of the kidneys. An "inverted V" bilateral subcostal oblique incision two fingerbreadths below the costal margins is carried through all the structures of the abdominal wall. The divided rectus fibers are ligated in bundles and the falciform and round ligaments of the liver are clamped, cut and ligated. The gastrocolic omentum is divided just below the greater curvature of the stomach at the left, and vasa breva ligated and cut as necessary to allow retraction of the stomach upward and to the right, and of the splenic flexure and transverse colon downward and to the left. Occasionally this latter movement requires division of the lateral leaf of peritoneum and downward displacement of the spleen. The tail of the pancreas and the splenic vessels can now be seen overlying the lower portion of adrenal and the renal vessels; after incision of the posterior peritoneum transversely they are retracted downwards. If their downward dislocation is hindered by the left gastro-epiploic vessels these may be divided.

The fingers are insinuated behind the kidney slightly lateral to the superior pole, bringing it forward and downward. A small lap sponge or narrow packing introduced into this space as the fingers are withdrawn maintains the more accessible position. A long Mixter forceps carrying a 24 inch length of Penrose tubing is passed superiorly to the renal vessels between and posteriorly to the superior pole of the kidney and the inferior pole of the adrenal to be caught and carried anteriorly at the junction of their superior poles. Gentle traction on this sling around the extension of Gerota's fascia between the two organs rotates the superior pole of the kidney forward and downward, bringing and holding the adrenal at least 2 inches anteriorly into the field. The adrenal vein, usually visible on the anterior surface of the gland, is divided between ligatures, after which three ligatures are carried between adrenal margins and diaphragm, great vessels and renal vessels, respectively, enclosing the adrenal arteries. As these are tied the adrenal is cut free along its borders, requiring only the division of the fascial extension between the kidney and itself to come free. We have not encountered vessels of any importance during this last division. The kidney falls back into place and after inspection of the field, usually dry, all other retraction is released.

To expose the right adrenal the omentum, transverse colon and duodenum are retracted downward and medially so as to carry the free right margin of the hepatoduodenal ligament to the left. The posterior peritoneum is identified where it is reflected off the bare area of the liver; it is incised vertically just to the right of the inferior vena cava and as far caudad as the renal vein. The right margin of the vena cava is retracted medially and the right adrenal vein sought behind it. The vein is cut between ligatures placed as close to the gland as possible. The Penrose tubing is then passed as on the left and the superior pole of the kidney, with the adrenal, dislocated upward into the operative field to facilitate the passing and tying of the three ligatures on the arteries. Lastly, the adrenal is cut free from the kidney completing the operation. Tension across the wound noted during the closure may be lessened by placing sandbags under shoulders and buttocks. Interrupted wire sutures have been used in the closure of the anterior rectus sheath. Primary healing is the rule, convalescence has been rapid and morbidity negligible with the preoperative preparation and postoperative maintenance on cortisone described by Huggins and Bergenstal.

SUMMARY

Both adrenals may most satisfactorily be exposed at one operation through an upper abdominal transperitoneal approach. A technic is described which allows gentle retraction under direct vision of the important structures in anterior relationship to the glands and minimizes the surgical trauma of bilateral resection. The operation is not more difficult than many upper abdominal procedures more frequently performed.

SIMPLE METHOD OF CONTINUOUS THORACIC DRAINAGE BY USE OF GLASS BUTTON

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THERE appears to be no precedent for the procedure which will be described here. Search of medical literature and correspondence with the editorial boards of medical publications fail to uncover any case in which the procedure has been used. Correspondence with Dr. Alfred Goldman, who is Chairman of the Committee on Surgical Therapy of the American College of Chest Physicians, stated that he had no information on the use of the Crosby-Cooney button for the treatment of hydrothorax.

In 1946 Crosby and Cooney[1] reported five cases of cirrhosis of the liver which were treated by a glass button of their design. Satisfactory improvement was noted in these cases. In 1948* I treated a case of portal cirrhosis in a woman, aged forty-two, who at that time had a liver enlargement which extended down to the level of the umbilicus. She was markedly decompensated with extreme dyspnea, a hugely distended abdomen and an incapacitating peripheral edema. On subsequent occasions 2 and 3 L. of ascitic fluid were withdrawn from her abdomen each time she was tapped. She was hospitalized, being bedridden at this time and completely unable to care for herself. Two gallons of fluid were drawn and one Crosby-Cooney button was placed in the lower third of the right rectus sheath. Her recovery was rapid and dramatic. At the time she was last seen (about four weeks before this article was written) she was quite well and able to carry on her normal activity just as she was before she became bedridden. She has never had a return of her abdominal ascites and hence has had no reason to be tapped.

In 1952 Chester L. Davidson[2] reported thirty-six cases of abdominal ascites in which a glass button was used. This was a modification of the Tannahill button. A variety of cases was reported here. There were two cases of abdominal tuberculosis, two of malignancy and one cardiac. All five of these were failures. However, of the thirty-one cases of cirrhosis there were twenty-six excellent results, one fair and four failures.

Anyone who has treated the unfortunate victims of pulmonary malignancy could not but be impressed by the sufferings of these patients because of the distressing symptoms, due to the massive pleural effusions. The pain and the dyspnea due to the pressure of the accumulated fluid, and the shifting of the mediastinal structures, necessitates the use of large doses of opiates and frequent thoracentesis to effect relief. It was thought that if some method of continuous pleural drainage could be devised, the necessity for the frequent taps would be obviated. Because of the very poor general physical condition of many of these patients, due to their malignancy, the loss of the proteins and metabolites, due to the discarded effusions, places a still greater drain upon their economy. The procedure, of necessity, should be a simple one which would not entail a prolonged or complicated surgical procedure. If satisfactory surgical drainage of the abdominal cavity could be secured by the use of a simple mechanical aid, as the Tannahill button or the Crosby-Cooney button, why would not the same procedure or device be effective in draining the pleural cavity?

CASE REPORT

On February 26, 1952, this eighty year old female was seen complaining of epigastric pain, anorexia, weakness and pain in the left flank and left shoulder. She was examined and x-rays of the chest, gallbladder and gastrointestinal tract were advised. It was not until April 11, 1952, that she found it convenient to have the x-rays requested. The physical findings were compatible with an eighty year old female but were not particularly noteworthy, excepting for dullness to percussion in the left chest and an absence of breath sounds on this side. The x-ray examinations revealed a negative chole-

* Borgess Hospital, Kalamazoo, Michigan, Case No. 117224, September 17, 1948.

FIG. 1. Taken April 10, 1952, film reveals the left chest completely filled with fluid.

cystogram, with no stones, normal upper gastrointestinal tract except for an abnormal small bowel pattern. The right lung was clear but there was an advanced left pleural effusion which displaced the heart to the right. (Fig. 1.)

She was hospitalized immediately and thoracentesis was done on two successive days; 1,100 cc. of pleural fluid was removed at one time and on the next day 1,000 cc. of fluid was removed. Decompression on both occasions was done quite gradually and the patient tolerated the procedure without shock and felt much improved thereafter. Stereoscopic examination of the chest now revealed the mediastinum in its normal position, absence of pleural effusion and a large lobulated mass, which would measure about 9 by 5 cm., projecting outward and upward from the hilus of the left lung.

Since neoplasm from no other site in the body could be demonstrated, it was assumed that the lesion was primary in the left lung.

Laboratory findings on April 15, 1952, were as follows: The specific gravity of the ascitic fluid was 1.013; microscopic studies of the smears showed albuminous material almost completely devoid of cells; smears and cultures were entirely negative for acid-fast bacilli; blood hemoglobin 76 per cent, 12.25, red blood count 3,560,000; color index 0.80, neutrophils 74 with Schilling index of 0-0-3-71; no basophils or eosinophils; Kahn test was negative; urinalysis revealed the color to be pale amber, cloudy, with specific gravity 1.018; sugar and acetone and albumin negative; white blood cells 5 to 8; no red blood cells; no casts or bacteria. (All laboratory findings are not listed for the sake of brevity.) The Papanicolaou test on sputum was negative.

The patient remained comfortable for about ten days and then began to complain of pain in the right chest which increased in severity day by day. On April 23, 1952, a thoracentesis was

FIG. 2. Films made September 4, 1952, three days before the patient died, reveal the button in place (indicated by arrow) and the tumor filling the entire left chest.

done with the withdrawal of about 500 cc. of fluid. She again became more comfortable. Appetite improved as did her general appearance.

On May 6, 1952, the patient was taken to the operating room and under sodium pentothal anesthesia the pharynx was sprayed with pontocaine 2 per cent and a No 35 French endotracheal tube placed in. Ether was given by the closed method. She received 500 cc. of whole blood during the procedure. Dr. Wm. P. Marshall was the anesthetist.

A U-shaped flap, including skin and superficial fascia and deep fascia, was reflected. The long axis of the U was parallel to the long axis of the ribs and included the areas spanned by the seventh, eighth, and ninth ribs in the midaxillary line. The periosteum of the eighth rib was incised and reflected for a distance of about 2 inches, and a section, approximately 5/8 inch long, was resected, and about 1,000 cc. of amber fluid aspirated. Then a Crosby-Cooney button, which was 7/8 inch long, was selected and a cotton ligature was threaded through the opening and the two free ends were attached to a hemostat. This was to prevent the button from being lost in the chest cavity, in the event that it should slip from the operator's grasp. The end of the button with the double flanges was placed in the pleural cavity in the space formerly occupied by the rib section. Two interrupted sutures of No. 24 cotton closed the periosteum so as to retain the button securely. The cotton suture, which had been previously threaded to prevent its loss, was now withdrawn. The flap was re-attached by means of a two-layer closure, using a continuous suture of chromic 00 for the deep fascia and a continuous suture of No. 40 cotton locked-stitch for the skin. Collodion dressing was applied. The anesthetic was carried along

under positive pressure from the time the chest cavity was opened. The air, which had entered the thoracic cavity, was then aspirated, using a No. 18 needle and a 50 cc. syringe to which a three-way stopcock was attached, while at the same time the lung was expanded under positive pressure. Less than 50 cc. of air were aspirated. A firm pressure dressing was applied to the chest, using an elastoplast bandage. The patient received a pint of blood while on the table and withstood the procedure without incident.

Stereo studies of the chest made three days later, May 9, 1952, revealed the button to lie in the opening of the eighth rib in the mid-axillary line. There was no fluid accumulation since the last x-rays were made.

The postoperative course was unusual in that she required no narcotics for postoperative pain. On the fifth day, Demerol® (75 mg.) was given for pain in the low back. She was kept in an oxygen tent for the first twenty-four hours but was out of bed on the second day and thereafter. She felt much improved generally and her morale was very good. Folbesyn® (1 ampule intramuscularly, daily), ascorbic acid (500 mg., q.i.d., intramuscularly) and high protein diet were given through her hospitalization. Penicillin S-R (400,000, q. 12 hours) and streptomycin (0.25 G., q. 4 hours) were also administered. She left the hospital on the sixth day (May 12, 1952) feeling much better than on admission. The skin sutures were removed on the tenth day at the office. Healing was by primary intention.

After discharge her only complaints were some backache, weakness and, when asked, "some soreness" over the operative site. On June 10, 1952, stereoscopic films noted there was no increase in fluid accumulation, however, the tumor was increased in size. X-ray films revealed approximately the same findings. In August, 1952, films were not made, due to an oversight. On September 1, 1952, she was re-admitted in a terminal condition. A sterno-clavicular lymph node, the size of a walnut, had appeared on the left. A stereoscopic film of the chest revealed the presence of some fluid in the left chest and a continued increase in the size of the lesion. (Fig. 2.) On thoracentesis, however, only 150 cc. of straw-colored fluid was obtained. She complained of severe pain in the neck and occiput, but none in the chest, nor was there evidence of respiratory embarrassment at any time. One-quarter gr. of morphine sulfate was given for the pain. On September 6th she expired suddenly.

Autopsy findings were not spectacular, excepting for the replacement of the left lung by the tumor. The only fluid was approximately an ounce in the small space between the tumor and chest wall. The open end of the button was in this space. Autopsy was performed by Dr. Hazel Prentiss.

COMMENT

1. The procedure is relatively simple and not attended by the probability of surgical shock.
2. It apparently was effective in securing drainage in this case.
3. The patient was practically pain-free until the end.
4. This method appears worthy of further trial.

SUMMARY

A simple method of continuous pleural drainage as a palliative procedure in malignancies is suggested. One case is presented and discussed.

REFERENCES

1. Crosby, R. C. and Cooney, E. A. Surgical treatment of ascites. *New England J. Med.*, 235: 581–585, 1946.
2. Davidson, C. L. Abdominal drainage in cirrhosis by use of glass button. *Am. J. Surg.*, 84: 233, 1952.

NEW DEVICE FOR OVERCOMING URETHRAL STRICTURE IN FEMALE

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THE female urethra is 1½ to 2 inches in length, pierces the urogenital diaphragm and extends from the base of the bladder to the external urethral orifice. Its course is slightly curved and runs roughly parallel to the vaginal axis. The urethra has three coats: (1) a mucous coat, (2) submucous and (3) muscular coat. The mucous coat consists of transitional epithelium, continuous with the bladder. The muscular coat consists of an outer circular and an inner longitudinal layer of muscular fibers. The circular fibers are distinctly developed at the neck of the bladder and there form a distinct sphincter. Just inside the external meatus lie skenes, glands and ducts.

There is a difference of opinion concerning the frequency of urethral stricture. Some authorities believe urethral stricture is not too common and almost rare, while others like W. E. Stevens, found 328 urethral strictures in 425 patients with urinary disturbances.

The fact that only a very small portion of the urethra is seen, and occasionally not at all, is one reason why this important canal is frequently overlooked in urinary disturbances. There is no doubt that urethritis preexists and coexists in urethral stricture, except in the congenital cases seen in infants and children in which anomalies may exist. Even in these cases vaginitis may exist. Study of the genitourinary tract is necessary to eliminate infection in the kidneys and ureters and, looking still further, eliminating other sources of infection in the mouth, sinuses, uterus and especially cervix, and also calculi in the kidneys or bladder. The latter are brought to light through retrograde pyelography under anesthesia.

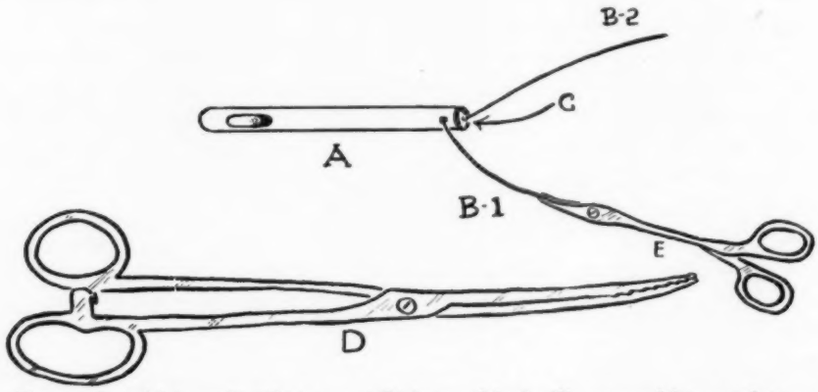

FIG. 1. A, rubber end catheter cut; B, heavy black silk sutured into catheter; C, catheter opening; D, thin uterine dressing forceps; E, mosquito clamp.

The important symptoms in order of frequency are: frequency of urination, pain, burning and urgency.

DESCRIPTION OF DEVICE

This simple device for overcoming urethral stricture consists of the front 2½ inches of a No. 14 French rubber catheter, which has two sutures of medium weight black silk taken at the end of the catheter; these sutures are tied and are placed in order to prevent the catheter from slipping into the bladder prior to dilatation. A small mosquito clamp is then placed on one end of the suture. (Fig. 1.)

A 2 per cent solution of butyn® or 1 per cent novocain® is instilled into the urethral canal and left *in situ* for five to ten minutes. Following this the sterile lubricated catheter is inserted, and a mosquito clamp placed on one of the ends of the black silk sutures. A thin

uterine dressing forceps lubricated with sterile lubricating jelly is then inserted through the catheter end and dilatation performed in the various quadrants of the clock.

The advantages of this simple method are the following: No metal touches the mucous membrane, its ease of use in the office and the fact that the procedure is almost painless. Dilatation should be performed at periodic intervals.

REFERENCES

EVERETT, H. S. Urethral stricture. Text Book of Gynecology, Obstetrics and Urology, pp. 102–119.

HUNNER, G. L. Chronic urethritis. *J. A. M. A.*, 56: 937, 1911.

STEVENS, W. E. Stricture of the urethra in women. *California Med.*, 20: 51, 1922.

STEVENS, W. E. Diseases of the female urethra. *California & West. Med.*, 26: 471, 1927.

O'CONOR, V. J. Diseases of the urethra in the female. *Am. J. Surg.*, 38: 148, 1937.

FROM the point of view of the average general surgeon, there are a certain number of objections to the operation of total gastrectomy. Not only is the technic more difficult and the mortality higher, but also no definite proof exists that a greater number of patients can be cured by this radical procedure as compared with the five-year results after subtotal gastrectomy. Finally, total gastrectomy causes interference with proper fat and protein assimilation in many patients so that they fail to regain their preoperative weight and nutritional status, although a high fat and low carbohydrate diet, taken frequently and in small quantities, will probably be helpful in many of these latter instances. (*Richard A. Leonardo, M.D.*)

Case Reports

CARCINOMA OF THE STOMACH*

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CANCER today constitutes one of the greatest and gravest problems in medical practice. After the third decade it is secondary only to cardiovascular disease as a cause of death, and approximately one-fifth of this mortality is caused by carcinoma of the stomach. Thus the subject is one of importance and is worthy of constant study.

It has been only within the past few years that statistics indicate a significant advance in the survival rate of patients with gastric carcinoma. As surgery has advanced undoubtedly many cases previously considered inoperable have responded more successfully to radical surgery. However, the over-all survival rate in unselected patients is still no greater than 10 per cent at most. A cure of cancer of the stomach is achieved very infrequently.

Although the stomach is a common site of a single malignant tumor, it is rarely involved by multiple primary malignant lesions. Brindley, Dockerty and Gray[2] reported twenty-three multiple malignancies of the stomach of 1,184 carcinomas of the stomach seen at the Mayo Clinic between 1932 and 1941, an incidence of 1.94 per cent. However, in reviewing the literature I have not found a case reported in which a second carcinoma occurred in the remaining segment of the stomach from which one carcinoma had been removed by subtotal gastric resection many years previously.

The following case report has two unusual aspects: (1) a carcinoma of the stomach was removed by subtotal gastric resection, with a seventeen-year cure; (2) a second carcinoma developed in the remaining portion of the stomach. The patient survived the removal of the remaining portion of the stomach, part of the esophagus, the spleen and part of the pancreas. Each tumor was diagnosed pathologically as malignant and the possibility of the second growth representing a metastasis of the first cancer was definitely excluded.

CASE REPORT

T. R. D., a white man aged sixty-six, was first seen September 18, 1934. Approximately six hours previously he had experienced sudden, generalized abdominal pain. The pain had increased in severity and the patient had vomited several times. No blood had been noted in the vomitus.

Eight weeks previously, and again within three weeks, the patient had experienced similar attacks but they were less severe. These attacks had lasted only several hours and had passed away without treatment by a physician. For several months the patient had symptoms of indigestion also, and some epigastric pain which was relieved by food, but was not affected by bisodol or bicarbonate of soda. There had been no appreciable loss of weight, but for some time the patient had felt rather weak. No blood had been noted in the stools.

When the patient was examined he was having severe generalized abdominal pain which was paroxysmal in nature. The abdomen was slightly distended and peristalsis was visible; moderate tenderness was present. There were no masses palpable. On auscultation active peristalsis was found. A rectal examination was negative and the rest of the physical examination was negative also. The pulse rate was 90 beats per minute and the respirations were 18 per minute. Urine examination revealed normal findings. Blood studies showed a white blood cell count of 10,800 per cu. mm.; red blood cell count of 4,350,000 per cu. mm.; lymphocytes 8 per cent, monocytes

* From The Doctors Hospital Research Foundation, Washington, D. C.

3 per cent and polymorphonuclears 89 per cent in the differential count and a hemoglobin of 86 gm. per cent.

A diagnosis of partial intestinal obstruction was made; the cause was undetermined. A flat x-ray plate of the abdomen confirmed this diagnosis as it indicated "a distended loop of small bowel in the lower abdomen extending from the midline to the left side."

The patient was treated by an adequate fluid intake, saline and glucose solution given intravenously, with nothing by mouth, enemas and morphine for pain when necessary. The symptoms gradually subsided and at the end of forty-eight hours he was comfortable. At that time liquids were started by mouth, and he was given 2 ounces of mineral oil three times daily. The patient continued to improve and by the fourth day he was taking a regular diet and having regular bowel movements. He was then discharged from the hospital.

On October 9, 1934, approximately two weeks after the patient left the hospital, a gastrointestinal x-ray examination was made. The roentgenograms revealed an ulcerating lesion which involved the posterior wall of the stomach at the greater curvature in the region of the angle; apparently this lesion was an ulcerating carcinoma. There was no evidence of obstruction and no abnormality in the colon.

On October 15, 1934, the patient was again hospitalized and prepared for operation. Nothing was administered by mouth, 2,000 cc. of 5 per cent glucose in saline was given intravenously and gastric lavage was done that evening and the next morning. The next day he was operated upon under avertin and gas anesthesia. The abdomen was opened through an upper right paramedian incision. Exploration revealed a large mass involving the posterior wall of the stomach at the greater curvature in the region of the angle. There were some enlarged glands in the gastrohepatic and the gastrocolic omentum. No evidence of metastasis was found in the liver or along the large vessels. In the mesentery of the upper ileum there was a hard nodule, about 1 inch in length, which had apparently obstructed the blood supply of the bowel at that point, with resulting fibrosis and slight constriction of the bowel. It was believed that this constriction was the cause of the original partial intestinal obstruction. Although the nodule was located at an unusual site, it was thought to be a metastatic involvement. A partial gastrectomy was done by the posterior Polya method, about two-thirds of the stomach being resected. Approximately 14 inches of the ileum was resected at the point of the mesenteric nodule and the constriction, an end-to-end anastomosis and an enterostomy proximal to the anastomosis being done.

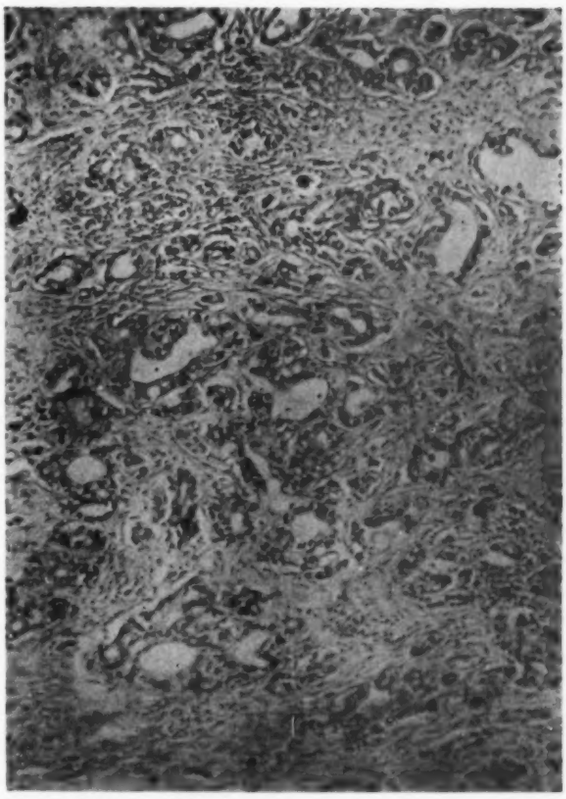

FIG. 1. Photomicrograph from specimen removed at operation October 15, 1934. × 96.

Examination of the removed specimen showed a large circular papillomatous mass 6 cm. in diameter on the posterior wall of the stomach. A section of the specimen showed a well differentiated adenocarcinoma under microscopic examination. No evidence of metastasis was found in the regional glands. Sections of the mesenteric nodule showed only dense fibrosis with no evidence of carcinoma. It was indicated that this nodule had resulted from a previous thrombosis of a small mesenteric vessel which had caused fibrosis and constriction of the small bowel at that point; this constriction would account for the partial intestinal obstruction which had been the reason the patient came to the hospital on the first occasion. (Fig. 1.)

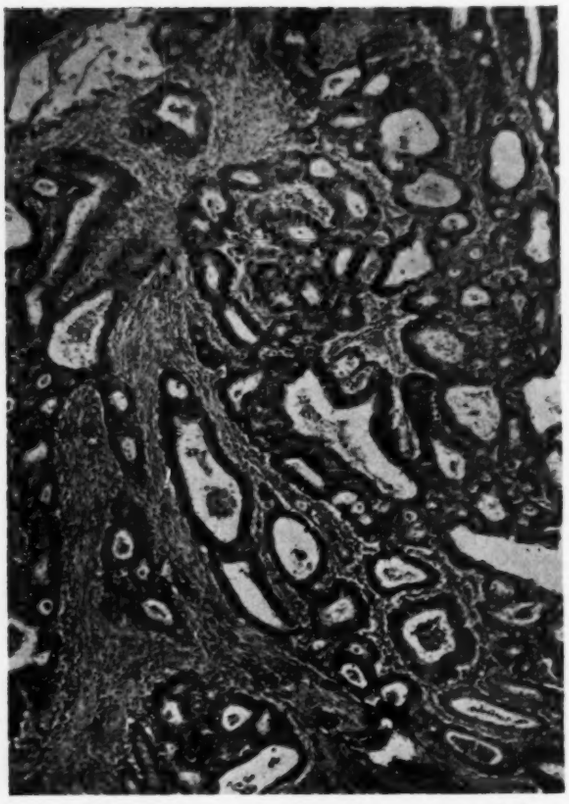

FIG. 2. Photomicrograph of specimen removed from stomach at operation March 14, 1951. × 96.

The patient's postoperative convalescence was uneventful except for a slight wound infection. He was discharged from the hospital on the twenty-fifth postoperative day; his wound was healed, he was on a liberal diet and was feeling well. The patient continued to gain weight and strength and returned to work as a machinist on December 17, 1934, two months postoperatively.

The patient continued to be in good health. On August 12, 1947, at the age of seventy-nine, he had a right inguinal hernia repaired. Convalescence from this operation was satisfactory.

The patient's good health continued until January, 1951, when he began to have epigastric discomfort, loss of appetite, occasional nausea and vomiting, tarry stools and weight loss. On March 6, 1951, a gastrointestinal x-ray examination revealed a polypoid type of growth filling almost the entire fundus of the stomach, extending almost down to the stoma. This appeared to be a polypoid type of carcinoma. The barium passed freely through the stomach and in six hours was in the terminal ileum.

On March 14, 1951, at the age of eighty-three, after transfusion and thorough preparation for surgery, a second laparotomy was performed. Under intravenous sodium pentothal and endotracheal gas-oxygen anesthesia the left ninth rib was subperiosteally resected and the pleural cavity opened. The left leaf of the diaphragm was opened and exploration revealed the entire remaining part of the stomach to be involved by carcinoma. The growth had extended into the pancreas, spleen and lower portion of the esophagus. There were several small nodules in the left lung which appeared to be metastatic carcinoma and there were several glands along the esophagus which also seemed to be metastatically involved. No evidence of metastasis was found in the liver. Although the condition appeared hopeless, a palliative resection was indicated. The entire remaining portion of the stomach, the lower end of the esophagus, spleen and the left half of the pancreas were removed in one block. The jejunum, which had previously been anastomosed to the stomach, was freed and the opening in the jejunum was closed. A loop of jejunum distal to this closure was brought up and anastomosed to the proximal cut end of the esophagus. An entero-enterostomy was made between the two limbs of the jejunal loop. The diaphragm was closed around the jejunal loop which had been joined to the esophagus. After the lung had been inflated by the anesthetist the chest wall was closed. A water-sealed closed drainage tube was used for the chest and the abdomen was drained by a cigarette drain to the pancreatic bed and brought out through a stab wound in the left upper abdominal wall.

Pathologic examination revealed "an adenocarcinoma of the stomach with invasion of the entire wall, with metastasis to the adjacent lymph nodes and the pancreas. The tumor is attached to, but does not invade the spleen." (Fig. 2.)

The postoperative course was very satisfactory and the patient left the hospital on April 15, 1951. He continued to be in very good condition until June, 1951. At that time he had loss of appetite and weight, weakness and jaundice, but experienced no pain. He died in a cachectic state on June 18, 1951.

COMMENTS

The outlook for a person with carcinoma of the stomach is dismal indeed; few people

are cured of this disease. However, in recent years there has been improvement in the operability rate, resectability rate, rate of five-year cures and a lowering of the mortality rate of this disease. Statistics from different clinics vary somewhat. A review of recent reports indicates an operability rate of approximately 70 to 80 per cent, a resectability rate of approximately 50 to 60 per cent, a mortality rate of approximately 5 to 7 per cent and a five-year cure rate of approximately 25 to 30 per cent.[1,3,5,7,8]

Swynnerton and Truelove[11] reported results of a study of 375 patients with carcinoma of the stomach during the period from 1938 to 1949, at the Radcliffe Infirmary, Oxford, England. Laparotomy was performed on 63 per cent of the patients and resection was done on 30 per cent of the total number. Only 5.6 per cent of all patients followed for five years remained alive; of those subjected to radical resection the proportion was 23.3 per cent and 0.7 per cent for the remainder group. It was observed that among the patients treated by radical resection the survival rate was greater when the preoperative history was long, and less when the preoperative history was short. The authors concluded that patients who gave long histories had slow-growing cancers.

Dr. William A. Cooper[4] reported a series of 687 patients with carcinoma of the stomach seen at the New York Hospital between the years 1932–1951. The analyses made in this series indicated progress has been made in the past two decades. In the period 1932–1940, 4.9 per cent of the patients had a five-year cure, including both operable and inoperable cases. During the years 1940–1951, 6.6 per cent of the patients had a five-year cure. No curative total resections were done in the 1932–1940 series. A more significant increase was noted in the three-year period; the percentage of cure during 1932–1940 was 5.7 per cent and during 1940–1951 it was 14.6 per cent. It was concluded that the increase in the three-year period was ample justification for the increased scope of surgery within the past ten years. Undoubtedly many patients who survived a five-year period subsequently died of the disease.

The improvement in these statistics is the result of the following rather than the result of earlier diagnosis: better preoperative and postoperative care; extension of operation to include the entire greater and lesser omentum, the entire lesser curvature of the stomach, portions of organs (liver, spleen, pancreas and colon) to which extension has occurred; a more determined effort to excise the entire lymphatic drainage area; and in some cases total gastrectomy. It is not possible to determine if the lesion is resectable or curable from the duration of the symptoms, the roentgenographic findings, the physical examination or the results of any other tests. A palpable mass or a large liver should not preclude operation, for in some cases resection can be accomplished and in other cases a lymphoma, sensitive to x-ray, may be found. Therefore, every patient with suspected carcinoma of the stomach should be operated upon if the general condition will permit surgery and, if possible, resection—curative or palliative—should be done and a pathologic diagnosis of the tissue made.

Gastric resection is the palliative procedure of choice; when technically practical it should not be withheld because the patient's disease is considered incurable. Other palliative procedures such as gastroenterostomy or gastrostomy are not worth while.

As the only possibility of cure and the greatest degree of palliation for gastric cancer at the present time is by surgical excision before the lesion has spread beyond the field of surgical extirpation, it must be diagnosed before widespread metastasis has occurred. State, Moore and Wangensteen[10] reported for a five-year period (1941–1945) a five-year survival rate of 56 per cent in the lymph node negative group and only 11.3 per cent in the lymph node positive group. In the patients who have been cured the diagnosis has usually been made early as the result of some fortunate circumstance or x-ray examination which revealed the neoplasm, as the case herein reported.

Early diagnosis of carcinoma of the stomach is rarely made because its beginning is so slow and insidious that diagnosis from symptoms is impossible. There is good reason to believe that the very presence of symptoms indicates a lesion that has been present approximately twenty months. Early diagnosis by other methods—x-ray, gastric analysis, gastroscopy and gastric cytology—is very infrequently made because (1) the condition must be sus-

pected before these methods are employed; (2) even these methods do not always demonstrate the early lesion. Thus there is an additional delay of four to six months before diagnosis is established and an operation undertaken. The very fact that most visceral cancers are treated after symptoms have supervened suggests that mainly we are dealing with advanced carcinoma and that metastases are already present. Were this not true the number of long time survivals after surgical treatment would be far greater.

It is doubtful if further improvement in surgical technic and a lowered mortality rate will result in any significant improvement in the gastric carcinoma problem unless earlier lesions are encountered more frequently. The key to better results is therefore earlier recognition and treatment. Improvement could be expected from better handling of the gastric ulcer problem. It is not possible to differentiate roentgenographically, nor otherwise, between benign and malignant gastric ulcers; only tissue examination can give accurate diagnosis. In view of the inherent possibility of malignancy in every gastric ulcer and the low operative risk, it is suggested that every gastric ulcer that does not heal within four or six weeks, and remain healed, be treated surgically. The large number of gastric ulcers are at present the only sizable symptomatic borderline group of lesions which may represent carcinomas in a stage favorable for cure. Improvement in the cure rate for gastric carcinoma now must come largely from immediate surgical resection of unhealed gastric ulcers.

In recent years attempts at mass x-ray examination of supposedly healthy people have been made in an attempt to find gastric carcinoma in its inception. So far this method has not been very practical nor productive of gratifying results. It is then apparent that until a method is available that is better than surgery for treatment of gastric carcinoma improvement in the rate of cure is dependent upon earlier diagnosis. Until a biologic test for cancer is discovered or better methods of detection of visceral cancer are found, earlier diagnosis can only be accomplished by better utilization of present methods.

Progress in the detection of gastric carcinoma may be made by: (1) General recognition of the long length of the silent interval (twenty months). (2) Annual scrutiny of groups of older people. (3) Development of screening tests, such as achlorhydria, for gastric cancer. (4) Emphasizing the idea that every doctor's office should be a cancer detection center. (5) Educating the public on the asymptomatic character of gastric carcinoma and the necessity of routine x-ray examination of the stomach. (6) X-ray examination of the stomach performed as part of an annual physical examination in military services, in veterans organizations, for employees in large industries, in labor unions, as part of the physical examination prior to the issuance of health and life insurance policies and as a routine procedure on all patients over forty years of age who enter hospitals. (7) Making facilities for gastric x-ray examination available to private physicians so that patients of all economic levels over forty years of age are given annual routine examination. (8) Further studies (gastroscopy, gastric analysis and repeated x-ray examinations) on questionable lesions found on fluoroscopic examination.

CONCLUSION

In the case that has been reported it was only the fortunate circumstance of an x-ray examination that the gastric carcinoma was discovered while it was in a curable stage. It was very unfortunate that the patient did not subsequently have regular periodic examinations, including x-ray examinations of the stomach, so that the second carcinoma would have been discovered at a time when it too could have been cured rather than palliated by resection of the remaining portion of the stomach. It was surprising and instructive to observe how well the patient withstood the second operation despite his advanced age, eighty-three years, and the magnitude of the operative procedure. A cure could not be expected as the second lesion was too extensive; however good palliation was obtained and the patient lived in a degree of comfort for three months and died without pain.

SUMMARY

1. A case of gastric carcinoma is reported which was cured by partial resection of the stomach.

2. A second gastric carcinoma developed in the remaining portion of the stomach

seventeen years later and a palliative resection was done.

3. A brief consideration of the gastric carcinoma problem is presented.

REFERENCES

1. Abrahamson, R. H. and Hinton, J. Gastric carcinoma. A comparative review of the origin, diagnosis and end-results in 583 patients. *Surg., Gynec. & Obst.*, 84: 481–489, 1947.
2. Brindley, G. V., Jr., Dockerty, M. B. and Gray, H. K. Multiple carcinomas; case. *Proc. Staff Meet., Mayo Clin.*, 18: 193–199, 1943.
3. Brown, C. H. and Kane, C. F. Carcinoma of the stomach: review of 406 cases seen from 1940–1945: operability, resectability and curability. *Gastroenterology*, 22: 64–79, 1952.
4. Cooper, W. A. The gastric cancer problem. In: Surg. Clinics North America, pp. 587–598. Philadelphia, 1952. W. B. Saunders.
5. Covert, F. M. and Brindley, G. V., Jr. Carcinoma of the stomach. In: Surg. Clinics North America, pp. 1425–1438. Philadelphia, 1952. W. B. Saunders.
6. Crymble, P. T. Fourteen-year survival following partial gastrectomy for pyloric carcinoma. *J. Internat. Coll. Surgeons*, 14: 524–526, 1950.
7. Guiss, L. W. End results for gastric cancer; 2,891 cases. *Internat. Abstr. Surg.*, 93: 313–331, 1951.
8. Harnett, W. L. A statistical study of 1,405 cases of cancer of the stomach. *Brit. J. Surg.*, 34: 379–385, 1947.
9. Rickles, J. A. Multiple carcinomas; case with 5 primary separate malignant lesions treated by total transthoracic gastrectomy. *Surgery*, 19: 229–236, 1946.
10. State, D., Moore, G. E. and Wangensteen, O. H. Carcinoma of the stomach: 10 year survey (1936–1945 inclusive) of early and late results of surgical treatment at Univ. of Minnesota Hospital. *J. A. M. A.*, 135: 262–267, 1947.
11. Swynnerton, B. F. and Truelove, S. C. Carcinoma of the stomach. *Brit. M. J.*, 1: No. 4753, 287–292, 1952.

UNUSUAL CAUSE OF MASSIVE GASTRIC HEMORRHAGE*

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THE present article is the report of a case of massive gastric hemorrhage of unusual etiology. A mass of lymphoid tissue which had retained the architecture of a normal lymph node was present in the mucosa. The surface was eroded and was the source of the hemorrhage. The retention of normal lymph node architecture is evidence against the mass being a true neoplasm of lymphoma type. As far as could be determined there is no report in the literature of a similar case. Its unusual character seems to justify this report.

FIG. 1. Mucosal study of stomach showing distortion by submucosal mass.

CASE REPORT

The patient was a white woman, seventy-six years of age, whose current illness was of five days' duration and sudden in onset. It was characterized by weakness and accompanied with some dizzy spells. The stools were black. There had never been any similar episode.

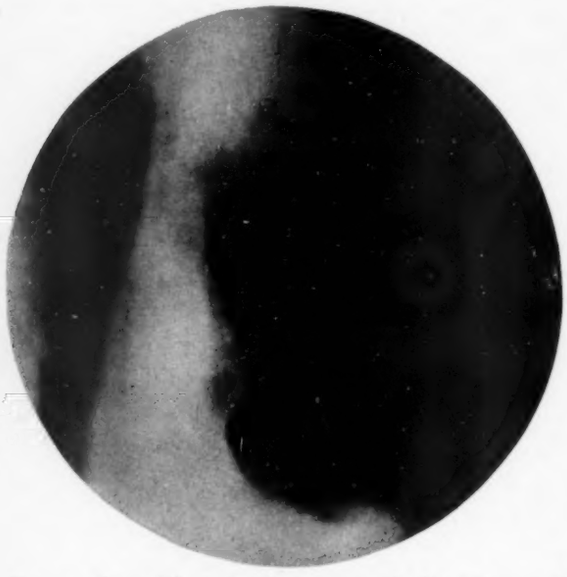

FIG. 2. Spot film showing mucosal distortion and niche formation.

On admission to the hospital physical examination revealed an evident anemia but nothing else of note. Hemoglobin was 8.25 gm. per cent; red blood cells 2,680,000; white blood cells 11,900, with a moderate shift to the left. The stools were positive for occult blood.

Roentgenologic studies showed an irregular filling defect measuring about 4 cm. in diameter on the posterior wall near the greater curvature (Fig. 1). Spot films (Fig. 2) disclosed a central niche slightly over 1 cm. in diameter, with overhanging edges. The impression was that the lesion was probably a leiomyoma although the possibility of carcinoma of the greater curvature had to be considered.

At operation a tumor measuring 3 inches in diameter and protruding into the lumen for a distance of 1 inch was seen on the posterior wall of the mid-third of the stomach. There was an ulceration ½ inch deep at the summit. The remainder of the stomach appeared

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FIG. 3. View of the tumor showing its submucosal situation, the normal lymph nodal architecture and the niche which was the point of hemorrhage.

normal. The tumor was removed locally with the overlying mucosa.

Grossly, the pathologic specimen (40480) was a roughly ovoid mass measuring 4.6 by 3 by 1.6 cm. covered by gastric mucosa. The mucosa was angry red, distended and at one site presented an ulcer 0.9 by 0.4 by 0.4 cm. The ulcer edge was perpendicular and its base reddish black. The mass sectioned with ease, revealing a homogeneous fish-flesh surface of tawny gray color. There was an occasional shallow wrinkle in the mass.

Microscopically, the mass in the gastric wall lay mainly in the submucosa and extended into the mucosa. (Fig. 3.) It was encapsulated where it lay in the submucosa and consisted of a large mass of lymphoid tissue with a normal architecture showing pulp and follicles. The follicles were rich in normal mitoses and the character of cells was well within normal limits. The surrounding cells of the pulp were normal small lymphoid cells. The mucosal surface over the summit of the mass was ulcerated and covered with fresh hemorrhage. The base was partially loose areolar tissue, partially the surface of the mass. There were very many dilated capillaries lying just beneath the surface. The mucosa up to the point of ulceration was perfectly normal. A few eosinophilic cells were scattered here and there and some small normal lymphoid follicles.

Diagnosis was local hypertrophy of lymphoid tissue with ulceration and hemorrhage.

CARCINOID TUMORS OF THE STOMACH*

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PRIMARY tumors of the gastrointestinal tract resembling carcinoma, but with distinctive appearance and behavior, have been well recognized since the work of Lubarsch[1] in 1888. He clearly distinguished between carcinoids and ordinary adenocarcinoma, although he traced the origin of carcinoids to the crypt cells. In 1907 Oberndorfer,[2] believing that these tumors were benign, employed the term carcinoid since they resembled carcinoma. Gosset and Masson[3] demonstrated the affinity of the intracytoplasmic granules of the cells of such tumors for silver salts and suggested they be called "argentaffin tumors."

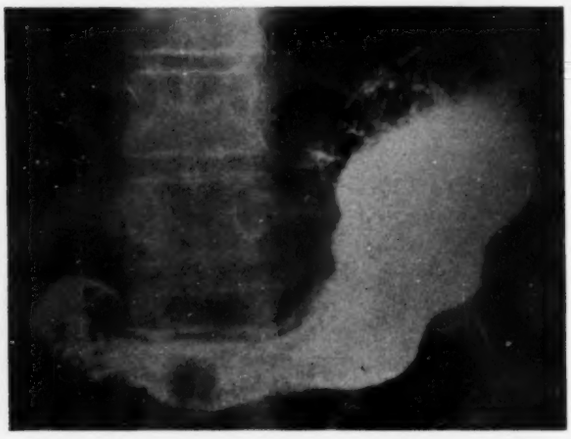

FIG. 1. Shows the filling defect in the stomach.

It is believed that carcinoids arise from cells of the gastrointestinal tract known by various names, but frequently referred to as Kultschitzky cells. The frequency of carcinoids in various locations is said to parallel roughly that with which Kultschitzky cells are found.[4] Thus the majority are located in the appendix, with comparatively few having been reported in the stomach. Pearson and Fitzgerald[5] state that at least eighteen such neoplasms of the stomach are on record. A tabulation of the reported cases and complete bibliography is available[6] and will not be duplicated here.

CASE REPORT

A thirty-two year old white man was hospitalized because of epigastric pain and "upset stomach" of eight to ten weeks' duration. The pain was precipitated by eating and was accompanied by epigastric distension. It would start soon after taking food and was described as being mild for the most part, but on occasions was severe and of a cramping nature. There was no radiation of pain and it did not seem to be associated with any particular type of food. Occasionally the patient experienced nausea with the attacks but never vomited. There was usually complete absence of distress when the stomach was empty. He had noted slight tenderness in the mid-epigastrium, both with and between attacks. There was no anorexia or weight loss. The past history was non-contributory.

Physical examination was not remarkable except for slight tenderness just to the right of the midline in the epigastrium. One examiner thought he felt a mass in this area, but this was not a constant finding.

Double contrast barium studies of the colon showed no demonstrable lesion. Upper gastrointestinal examination, after barium, revealed a filling defect 2 cm. in diameter, in the pyloric end of the stomach. This was not movable and was visible only with pressure on the pyloric area. No ulceration was observed. (Fig. 1.)

At operation a small tumor was found on the greater curvature in the antral portion of the stomach. The serosa was not involved and

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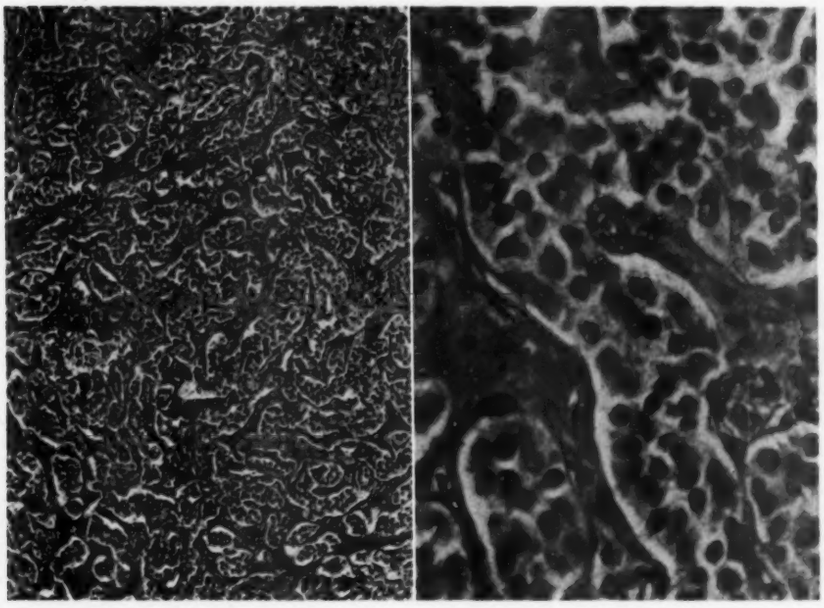

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FIG. 2. Low power magnification shows characteristic pattern. FIG. 3. High power magnification.

there were no enlarged lymph nodes. A V-resection was done and the stomach was closed in two layers. The postoperative course was uneventful.

The specimen consisted of a 5 cm. segment of stomach with a 1.5 cm. dome-shaped elevation on the mucosal side; the mucosa was somewhat reddened over the mass, but there was no ulceration. A section bisecting the specimen revealed a rounded, unencapsulated, yellow tumor 1.5 cm. in diameter involving the mucosa and submucosa but not infiltrating the muscle layers. In the most superficial portion was a cystic area 4 mm. in diameter.

The tumor was made up of small, uniform cells arranged in nests and broad cords. The nuclei were uniform in size and shape, somewhat vesicular with a coarsely clumped chromatin pattern. There were no mitoses. The cytoplasm was scanty, faintly eosinophilic and finely granular. The cell boundaries were indistinct. Irregular fibrous trabeculae surrounded the nests and cords. The cyst in the superficial part of the tumor was a deep dilated crypt, lined with mucin-forming cells which appeared normal in all respects. The tumor was capped by somewhat atrophic and congested gastric mucosa. It extended down to, but did not involve, the inner muscle layer of the stomach. (Figs. 2 and 3.)

COMMENTS

The malignant potentiality of carcinoid tumors is well established, although such tumors of the appendix have a much lower incidence of metastasis than do those situated elsewhere in the gastrointestinal tract. This difference is not surprising since other neoplasms have varied biologic behavior dependent to a greater or lesser degree on their location. It is also probable that tumors occurring in the appendix are likely to produce obstructive symptoms, perhaps with resultant inflammation, and thus give rise to symptoms at an earlier date than those occurring elsewhere in the gastrointestinal tract where obstruction would require a tumor of greater magnitude than the average carcinoid attains. Although there are only some twenty-three reported cases of metastasis from appendiceal carcinoids,[5] 38 per cent of extra-appendiceal carcinoids are said to have shown node involvement or distant metastasis and of eighteen previously recorded stomach carcinoids, four showed metastasis.[5]

There seems to be little rationale for considering certain carcinoids benign and others malignant on histologic grounds since all gradations of histologic variations have been known to metastasize. The average carcinoid has a monotonously uniform cellular pattern;

it is only the occasional tumor that manifests varying degrees of cellular pleomorphism.[6,7,8] Likewise the festooned appearance noted in rectal carcinoids[7,9] does not allow one to predict a different natural history for that particular tumor. There seems to be ample evidence that the tendency toward alveolus or gland formation in a particular tumor, or the failure to demonstrate argentaffin granules, should in no way interfere with the recognition of an otherwise characteristic lesion as a carcinoid.

The clinical diagnosis of carcinoid tumors is usually quite impossible. There are neither symptoms, signs nor laboratory aids that could be considered in any way characteristic. As often as not they are discovered incidentally at time of surgery or autopsy. It is only after examination of the specimen that diagnosis can be made with certainty. However, when the surgeon encounters a submucosal tumor in the gastrointestinal tract, especially if the tumor is small or multiple, or if it has the typical yellow appearance on sectioning, the possibility of carcinoid should be kept in mind and adequate extirpation performed. One of the problems of surgical management results from the fact that one-third of these tumors show multiple foci of origin.[10] We have seen a case of multiple carcinoids throughout the jejunum and ileum with metastasis to the liver and lungs. It would thus seem wise to search further when a single tumor is discovered.

SUMMARY

A case of carcinoid tumor of the stomach is presented and briefly discussed.

We are in agreement with the concept that carcinoids are malignant tumors and that prediction of benign behavior cannot be made on a morphologic basis, although the location of the tumor has important implications concerning its biologic behavior.

The only suitable method of treatment is surgical extirpation and, because of the tendency for the tumors to be multiple, a thorough search for other foci is indicated.

REFERENCES

1. Lubarsch, O. Ueber den primären Krebs des Ileum nebst Bemerkungen über des gleichzeitige Vorkommen von Krebs und Tuberculose. *Virchows Arch. f. path. Anat.*, 111: 280–317, 1888.
2. Oberndorfer, S. Karzinoide Tumoren des Dünndarms. *Frankfurt Ztschr. f. Path.*, 1: 426–432, 1907.
3. Gosset, A. and Masson, P. Tumeurs endocrines de l'appendice. *Press méd.*, 22: 237–240, 1914.
4. D'Albora, J. B. and Ingegno, A. P. Carcinoid tumors of the small bowel. *Gastroenterol.*, 10: 310–326, 1948.
5. Pearson, C. M. and Fitzgerald, P. J. Carcinoid tumors: A re-emphyasis of their malignant nature. *Cancer*, 2: 1005–1026, 1949.
6. Martin, J. D. and Atkins, E. C. Carcinoid of the stomach. *Surgery*, 31: 698–704, 1952.
7. Horn, R. C. Carcinoid tumors of the colon and rectum. *Cancer*, 2: 819–837, 1949.
8. Masson, P. Carcinoids (argentaffin-cell tumors) and nerve hyperplasia of the appendicular mucosa. *Am. J. Path.*, 4: 181–212, 1928.
9. Stout, A. P. Carcinoid tumors of the rectum derived from Erspamer's pre-enterochrome cells. *Am. J. Path.*, 18: 993–1009, 1942.
10. Dockerty, M. B., Ashburn, F. S. and Waugh, J. M. Metastasizing carcinoids of the ileum. *Proc. Staff. Meet., Mayo Clin.*, 19: 228–235, 1944.

USE OF THE BILLROTH I AS A SECONDARY PROCEDURE*

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THE recent resurgence of popularity of the Billroth 1 method of re-establishing gastrointestinal continuity after gastric resection may be attributed to several factors. Among these is recognition of the fact that gastroduodenal anastomosis can be accomplished with relative ease in a high percentage of patients with duodenal disorder.[1] In addition, many authors[2,3] believe that the Billroth 1 method is the superior procedure from the standpoint of postoperative function. It is not surprising therefore that it also finds acceptance as a secondary procedure. This has recently been emphasized by Perman[4] and Bohmansson[5] who found it advantageous in the treatment of postgastrectomy complications in cases in which gastrojejunostomy had been done primarily. Teicher[6] reported a case in which conversion of a gastrojejunostomy to a gastroduodenostomy alleviated symptoms arising from a "malfunctioning stoma." Clagett and Waugh,[2] Maingot[7] and Balfour[8] all stressed the value of using this technic in instances of gastrojejunal ulceration.

We recently had the opportunity to use this method in treating a patient with a perforated jejunal ulcer. A revision of the gastric resection and conversion of a gastrojejunostomy to a gastroduodenostomy was done. A report of this case follows.

CASE REPORT

F. R., a seventy-six year old white man, was initially admitted to King County Hospital on September 18, 1944, with an acute gastrointestinal hemorrhage. At that time x-ray examination showed a duodenal ulcer. Following his recovery from this acute episode the patient was discharged to the care of the outpatient clinic but did not return until May 30, 1947, when he was seen there with complaints suggesting peptic ulcer. X-rays showed a deformity of the duodenal bulb. Medical treatment was initiated and continued for three months without apparent benefit. Subsequent to this the patient was not seen until December 18, 1949, when he was admitted to the hospital with an initial diagnosis of "perforated viscus."

It was noted that a gastric resection had been done elsewhere since the date of his last clinic visit, but due to memory failure he was unable to give the exact date of this procedure. Surgery on December 18, 1949, revealed perforation of a retrocolic jejunal ulcer near the site of a gastrojejunostomy. A simple closure of the perforation was done and after an uneventful recovery the patient was discharged on January 6, 1950. He was re-admitted on January 23, 1950, with a history of diarrhea of two days' duration associated with cramping abdominal pain and nausea. On January 28, 1950, gastrointestinal x-rays failed to demonstrate the presence of an ulcer. Barium enema showed extensive diverticulosis and possibly diverticulitis of the colon. Carcinoma could not be excluded. On February 23, 1950, a partial left colectomy was done and that portion of the colon bearing diverticuli was removed. No evidence of carcinoma was noted.

After recovery from this procedure the patient was without symptoms until April 5, 1951, when he was again admitted to the hospital because of abdominal pain of three days' duration. The pain was located in the left lower quadrant and was associated with nausea and vomiting. There was tenderness, rebound tenderness and muscle spasm, localized to the left lower quadrant. Rectal tenderness was noted on the left. Peristalses were hyperactive. X-rays showed no free intraperitoneal air and were interpreted as being compatible with a partial small bowel obstruction. The patient was treated conservatively by intubation and within a few days all signs and symptoms had subsided. He was discharged only to be re-admitted with similar complaints on May 28, 1951.

At the time of the patient's last admission to

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the hospital (May 28, 1951) he complained of severe abdominal pain of thirty-six hours' duration. The pain was described as being sharp, continuous and non-radiating and was located in the left lower quadrant of the abdomen. There had been nausea without vomiting but no disturbance in bowel habits.

Examination revealed slight abdominal distention. There was tenderness, rebound tenderness and abdominal rigidity confined to the left lower quadrant. Left rectal tenderness was present. Peristalses were hyperactive. The white blood cell count was 13,000 with 83 per cent neutrophils. There was no fever. Abdominal x-rays again suggested partial small bowel obstruction and treatment by intubation was initiated. On June 1, 1951, there was increasing abdominal distention and at this time free intraperitoneal air was demonstrable by x-ray. The patient was then subjected to surgery.

Upon opening the abdomen and after extensive dissection of numerous small bowel adhesions, a collection of fluid resembling gastric content was found in the left paracolic area. Further dissection exposed the gastrojejunostomy site. The distal limb of the jejunal loop was markedly thickened and edematous for a distance of 25 cm. On the posterior jejunal wall, 8 cm. from the margin of the gastrojejunostomy, there was a large perforated ulcer. The previous gastric resection had been inadequate in its extent (only about 20 per cent according to our estimate at operation) and was therefore extended to include the entire lesser curvature and an additional 15 cm. along the greater curvature. The jejunal loop was transected above and below the gastrojejunostomy* and the ulcerated and edematous portion was excised. The cut ends of the jejunum were reunited by end-to-end anastomosis. The duodenum was mobilized utilizing the Kocher technic. A transverse incision was made anteriorly in the duodenal wall after which an end-to-side gastroduodenostomy was carried out by a modification of the von Haberer-Finney procedure.

After an uneventful recovery the patient was discharged from the hospital on June 16, 1951. Subsequent visits to the outpatient clinic have disclosed an absence of gastrointestinal symptoms of any kind. Except for a small gastric volume necessitating a six meal diet schedule the patient has no dietary restrictions and has gained 39 pounds since surgery. On his last visit (May 3, 1952) he was considered to be in excellent condition.

* The original gastrojejunostomy had been done at least 10 cm from the ligament of Treitz and with the afferent loop attached to the lesser curvature of the stomach.

SUMMARY AND CONCLUSIONS

1. The Billroth 1 method of re-establishing gastrointestinal continuity after gastric resection is a useful tool in the treatment of complications arising at the site of a gastrojejunostomy.

2. A case is reported in which a gastrojejunostomy was converted to a gastroduodenostomy as treatment for a perforated jejunal ulcer.

REFERENCES

1. Moore, H. G., Jr. and Harkins, H. N. Experiences with the Billroth 1 subtotal gastric resection. *West. J. Surg.*, 60: 264, 1952.
2. Clagett, O. T. and Waugh, J. M. Indications for and advantages of Shoemaker-Billroth 1 gastric resection. *Arch. Surg.*, 56: 758, 1948.
3. Polya, E. Re-establishment of the gastro-intestinal passage after gastric resection. *Surg., Gynec. & Obst.*, 70: 270, 1940.
4. Perman, E. So-called dumping syndrome after gastrectomy. *Acta med. scandinav.*, (supp. 196) p. 361, 1947.
5. Bohmansson, G. Prophylaxis and therapy in late post-gastrectomy complications. *Acta med. scandinav.*, (supp. 246) p. 37, 1950.
6. Teicher, I., Friedman, M. N. and Lipton, S. Malfunctioning stoma following subtotal gastrectomy, corrected by converting a gastrojejunostomy to gastroduodenostomy, report of a case. *Ann. Surg.*, 134: 1058, 1951.
7. Maingot, R. Abdominal Operations, New York, 1948. Appleton-Century-Crofts, Inc.
8. Balfour, D. C. The status of "Billroth No. 1" in the surgery of stomach and duodenum. *Surg., Gynec. & Obst.*, 58: 917, 1934.

PRIMARY SIDE-TO-SIDE ANASTOMOSIS FOR CONGENITAL ATRESIA OF SMALL BOWEL*

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CONGENITAL atresia of the small bowel has been described by Overall and Kirkley,[1] Földes,[2] Snyder, Voskamp and Chaffen,[3] and Grove and Rasmussen.[4] Ladd and Gross[5] described two forms which may occur. In one variety the intestine has a blind sac and there is continuity of the bowel. The second form presents a diaphragm or veil which completely blocks the lumen. This second type is the less common form. This condition has an extremely high mortality rate due to vomiting and consequent dehydration. There is the likelihood of rupture of the dilated blind intestinal loop. If no surgical relief is instituted, death may occur in the first week of life. Surgical therapy is followed with a high mortality rate and an increasing number of cases are appearing in the surgical literature.[6] Early diagnosis made by alert physicians is the best hope of a successful outcome. Ladd and Gross state that no patient had been treated successfully before 1910. However, some fifty-two patients were treated by surgery at the Children's Hospital in Boston. Of the five patients with atresia of the duodenum, four were treated with duodenojejunostomy and there were no recoveries. One was treated successfully with an anterior gastrojejunostomy. Of the six patients with jejunal atresia, one was treated unsuccessfully with duodenojejunostomy and the other five with jejunoileostomy; two patients died and three recovered. Thirty-four had ileac obstruction. All of the three patients who survived had primary anastomosis. Ileostomy had been abandoned because of uniformly fatal results. The remaining seven cases involved the ileocecal colon and were all fatal. Baranofsky[7] described a primary end-to-end anastomosis for congenital atresia of the small bowel. We should like to present such a case in which there was surgical intervention with survival.

CASE REPORT

B. R. (Kensington Hospital No. 6334), a male, was delivered normally on December 28,

FIG. 1.

1951. He weighed 7 pounds, 2 ounces, and appeared to have normal body features in every respect. The baby's first feedings were glucose water, and on December 30th he was taken to the mother's breast. On December 31st it was noted that the infant regurgitated small amounts of dark green, bile-stained material and that his weight was down to 5 pounds, 12 ounces. From this time on the baby vomited every feeding and the epigastrium became markedly distended. Peristaltic waves were readily seen to pass from left

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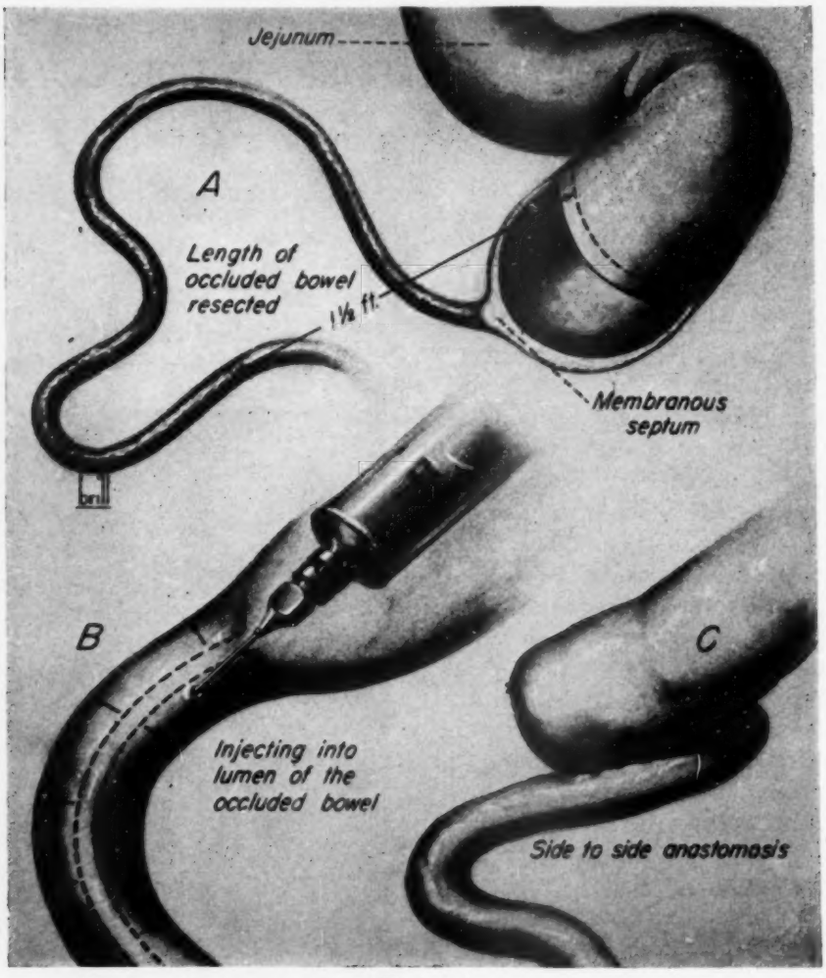

FIG. 2.

to right. An x-ray of the abdomen, taken with the baby inverted, revealed practically no gas in the intestinal tract, gas being noted only in the stomach. (Fig. 1.) Surgical intervention was decided upon and a catheter was inserted through the nose for the purpose of suction.

The infant was anesthetized with 1 per cent procaine infiltration, supplemented with nitrous oxide and oxygen. A right mid-rectus incision was made. Immediately upon opening the peritoneal cavity a large dilated loop of small bowel protruded through the opening. This was extremely thin-walled but healthy in color and glistening. It was filled with gas and small amounts of fluid. Careful examination of the abdominal contents revealed the following: The stomach was distended with a large volume of gas and fluid. The duodenum and jejunum were similarly distended. There were multiple, fine adhesions running over the surface of the duodenum and jejunum. This distended state continued for approximately 15 cm. beyond the ligament of Treitz. It was here that the point of obstruction was noted. There was a complete diaphragm within the lumen of the intestine. Beyond this point the bowel was completely contracted and collapsed, the lumen being perhaps 2 mm. in diameter in this area. The collapsed bowel was continuous with the proximal dilated portion. At this time a search was made in the collapsed bowel to ascertain if any other deformities could be demonstrated. This was done by an injection of saline into the lumen with a fine needle, and it was noted that the saline went through the entire collapsed bowel into the cecum. It was believed that in view of the questionable viability of the bowel, the procedure indicated was resection of the dilated portion of the jejunum as far proximal as the ligament of Treitz. Therefore 12 cm. of bowel

were excised, including the point of obstruction, and approximately 2 cm. of collapsed bowel removed beyond this point. A side-to-side anastomosis was then accomplished between the dilated and the contracted small bowel. A two-layer closure was used with atraumatic chromic interrupted catgut sutures on the mucosa, and fine black silk interrupted sutures on the serosa. The mesentery was then repaired, and the abdomen was closed with a continuous chromic suture in the peritoneum and dermal tension sutures through the skin and fascia. (Fig. 2.)

The patient was in good condition following surgery and was returned to a heated crib, supplied with a continuous flow of oxygen and aspirated frequently. Nothing was given by mouth and small clyses of 2½ per cent glucose in 0.5 normal saline solution were given to maintain fluid balance. Antibiotics in the form of penicillin were given, as well as 2 cc. of adrenal cortical extract.

For the first thirty-six hours the abdomen was somewhat distended. Fluids were cautiously started by mouth on the second postoperative day. A rectal tube was inserted and stool (which was mostly mucous) was noted fifty-five hours postoperatively. A formula of evaporated milk, water and dextri-maltose was started on the third day. On the fifth day the cortical extract was reduced to every other day, and was discontinued on the twelfth postoperative day. On the sixth day a separation of the abdomen was noted. Adhesive butterfly bridges were used effectively. The infant gradually improved, and on the sixth day the child's stools appeared normal in color, odor and consistency. The patient was discharged on the thirtieth postoperative day weighing 6 pounds, 6 ounces. He was taking a regular formula and the wound was completely healed. It was planned to investigate the gastrointestinal tract by x-ray at a later time. At the time of discharge it was noted that there were signs of cerebral irritability and the child was to be brought in for a follow-up examination.

On March 5, 1952, the child was readmitted for evaluation. At this time he weighed 9 pounds, 3 ounces, and the wound was completely healed. A gastrointestinal study was done, as shown in Figure 3. Studies by the neurologist failed to show any significant cerebral involvement. The child was thereupon discharged improved and was to be followed up with periodic examinations.

FIG. 3.

The child was seen at the outpatient clinic on August 15, 1952, at which time his weight was 17 pounds, 4 ounces. The abdominal wound was well healed and had shrunken considerably. The child was eating well and had had no complaints since the discharge from the hospital.

CONCLUSION

A case of jejunal atresia in an infant is presented, with complete recovery after end-to-end anastomosis. It is believed that the presentation of this case will serve to alert physicians to the recognition of this condition, and that survival is possible with early surgical intervention. Although side-to-side anastomosis with its blind loops is not ideal, it is our belief that in those patients with marked disparity of loops of bowel, it may be of definite value.

Acknowledgment: The author wishes to express his sincere appreciation to the pediatric nurses of the Kensington Hospital and to Dr. George Elson who aided in the pre- and postoperative management of this infant.

REFERENCES

1. Overall, J. C. and Kirkley, J. A. Intestinal obstruction in infants and newborn. *J. Tennessee M. A.*, 43: 397–404, 1950.
2. Földes, L. Congenital jejunal atresia in newborn. *Gyógyászat*, 73: 788–790, 1933.
3. Snyder, W. H., Voskamp, J. R. and Chaffen, L. Congenital atresia of newborn. *West. J. Surg.*, 58: 638–642, 1950.
4. Grove, L. and Rasmussen, E. Congenital atresia of small intestine. *Ann. Surg.*, 131: 869–878, 1950.
5. Ladd, W. E. and Gross, R. E. Abdominal Surgery of Infancy and Childhood. Philadelphia, 1941. W. B. Saunders Co.
6. Webb, C. H. and Wangensteen, O. H. Congenital intestinal atresia. *Am. J. Dis. Child.*, 41: 262, 1931.
7. Baranofsky, I. D. Primary end to end anastomosis for congenital atresia of the small bowel. *Surgery*, 30: 841–844, 1951.

About 4 per cent of all cervical cancers are found in stumps; however, less than 1 per cent of all patients subjected to supracervical hysterectomy subsequently develop cancer in the retained stump. Thus, unless a surgeon is experienced in doing total and panhysterectomies, he might better continue to leave the cervical stump; the increased operative mortality would make the more radical operation unjustifiable. Many cancers in cervical stumps are seen too late for effective therapy; but if the ureters are not yet involved and no widespread fixation or metastases are obviously present, many of these patients can be relieved or cured by surgery and irradiation. If most of the normal epithelial cells in vaginal smears show radiation changes during and upon completion of radiotherapy, a favorable prognosis is justified; otherwise only surgery can afford relief. Patients with cervical stumps should be checked frequently for possible malignant degeneration. (*Richard A. Leonardo, M.D.*)

DIVERTICULA OF THE FOURTH PORTION OF THE DUODENUM*

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DUODENAL diverticula are encountered fairly frequently, occurring in about 1 per cent of all gastrointestinal x-ray series. There has been no uniform opinion in the past as to whether diverticula so encountered should be removed. Key[9] in 1915 first removed a duodenal diverticulum which had been demonstrated fluoroscopically. Mahorner[6] by his presentations has done much to crystalize the opinion on the subject.

It has been well established that asymptomatic duodenal diverticula should not be attacked surgically. The same holds true if minor symptoms are present.

Etiology. It has been noted that all diverticula occur on the concave side of the duodenum and it has been postulated that this incidence is due to a place of lower resistance where the vessels penetrate the duodenal wall. Another possibility is that some of the diverticula originated as a congenital out-pouching with later enlargement. This seems more likely in those in the region of the ampulla of Vater.

Symptomatology. The incidence of symptoms in duodenal diverticula is probably about 10 per cent. One of the most frequent symptoms is a dull pain in the epigastrium, to the right of the midline about mid-way between the umbilicus and xyphoid. Nausea (possibly due to distention in the diverticulum) is the other most frequent symptom. Tenderness may be present if the diverticulum is inflamed. Other symptoms that have been mentioned are diarrhea, possibly due to pancreatic disturbance, and weight loss.

Location. The most frequent site for diverticula is in the second descending position of the duodenum near the ampulla of Vater. About two-thirds of the diverticula occur in this location. The next most frequent sites, in order of incidence, are the third and fourth portions. What appears to be diverticula sometimes occur in the first portion of the duodenum, but practically all of these are pseudodiverticula. They are expansions of the duodenum or pouches developing proximal to an obstructive duodenal ulcer.

The diagnosis must always be established by fluoroscopic and x-ray studies. Surgery is indicated in only a very small percentage of these cases. All other possible explanations for the symptoms must be carefully excluded. A trial of medical treatment is always indicated. Surgery should not be advised until after careful exclusion, a long trial of medical treatment and a demonstration of residual pooling in the diverticulum of barium for four to six hours. Even then, surgery is indicated only if the symptoms are severe.

Mahorner[5,6] has suggested several advances in surgical technic, particularly for diverticula of the second portion of the duodenum.

Mino[7] has reported the successful removal of a diverticulum of the third portion of the duodenum and has suggested an exposure technic for excision of diverticula of the third and fourth portions. One case of the successful removal of a diverticulum of the fourth portion of the duodenum has been reported in the readily available American literature.[8]

Undoubtedly, other diverticula of the fourth portion of the duodenum have been removed but were either not reported or the reports were overlooked. We wish to add a second and third case of removal of a diverticulum of the fourth portion of the duodenum and discuss certain of the clinical aspects.

CASE REPORTS

CASE 1. R. H., a sixty-four year old white man, was admitted to the Spartanburg General Hospital (No. 24,963) on July 29, 1951, complaining of epigastric distress, including pain and nausea, for the past ten years. He had

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FIG. 1.

FIG. 2.

received prolonged therapy, including antispasmodics and sedatives. The symptoms usually occurred following meals, although nausea was present just before meals. The patient had also noted dark blood in his stools in 1918, although, subsequently, no melena had been noted.

The systems review was essentially negative except for nocturia (times 1) and intermittent prolapse of hemorrhoids.

Physical examination revealed a well nourished, healthy white man in no particular discomfort. The pupils were regular and reacted to light and accommodation, and no difficulties of the eyes, ears, nose and throat were noted. The thyroid was not palpable, and no other masses were noted in the neck. The lungs were clear and the heart was regular in rhythm and rate at 80. The blood pressure was 140/80.

On examination of the abdomen a soft mass, apparently confined to the skin layers, was present in the midline. This mass was nontender. In addition, moderate tenderness in the right epigastric region was noted. No inguinal masses were present. Rectal examination revealed a slightly enlarged prostate which was firm in consistency. Examination of the lower extremities revealed moderate varicosities, bilateral. No edema was present. The admission diagnosis was chronic cholecystitis, epigastric and scalp lipomas and varicose veins. Initial laboratory examinations were essentially normal. A gastrointestinal series and gallbladder series were obtained on August 1, 1951, and the following reports were noted. The gallbladder was essentially normal except for slight impairment of the concentrating power. The gastrointestinal series (Fig. 1) was reported to have a "very large diverticulum of the superior flexure of the duodenum."

In consideration of persistent symptoms in this patient over a long period of time, in spite of considerable medical therapy, surgical extirpation of the diverticulum was recommended. On August 4th surgery was performed under general anesthesia. Examination of the superior portion of the duodenum revealed considerable distention, but no diverticulum was found. Posterior to the first portion of the duodenum the fundus of a diverticulum was seen. Subsequent mobilization from the gastrohepatic omentum and the duodenum revealed the origin of the mass to be in the fourth portion of the duodenum. The diverticulum presented behind the stomach and anterior to the pancreas. It was held in this abnormal position by passing under the pancreaticoduodenal vessels. The estimated size at surgery was 6 by 3½ cm. It was possible by constant traction and blunt and sharp dissection to expose the fourth portion of the duodenum through the gastrohepatic omentum. The diverticulum was excised, leaving a small cuff for suturing. The duodenal defect was closed transversely with interrupted intestinal sutures, with an outer layer of cotton mattress sutures. (Fig. 2.) No other diverticula were present. The gallbladder was normal.

Before closing the abdomen dissection of the epigastric mass revealed the presence of a small defect in the rectus fascia in the midline and a small amount of properitoneal fat protruding through this opening. The hernia was repaired and the abdomen closed without drainage.

The patient withstood surgery well and returned to his room in good condition. Postoperatively he was placed on continuous gastric suction, parenteral fluids and proteins, antibiotics and vitamins for a period of six days. He was ambulated on the third postoperative day. At this time gastric intubation was discontinued. The patient was then placed on a progressive Sippy diet, supplemented by oral protein feedings. His postoperative course was uneventful except for a small accumulation of serosanguinous fluid in the incision. He was discharged asymptomatic on August 20, 1951, sixteen days following surgery. The patient was seen, subsequently, and had a good appetite without return of epigastric distress. The wound has healed without further complication.

CASE II. O. M., a sixty-three year old widowed white woman, was admitted to the hospital (No. 33,053) on January 15, 1952, with a history of pain in the lower chest, shoulders and upper arms, and soreness in the epigastric region of five years' duration. Nausea and occasional vomiting were also present. She had considerable intolerance to heavy foods, especially greasy foods. Just prior to admission episodes of pain were also noted in the right upper quadrant.

For several years the patient had received antispasmodics, narcotics and other supportive measures to relieve her difficulties. The admission diagnosis was possible chronic cholecystitis.

A cholecystogram on January 16th revealed a normal gallbladder. On January 18th an upper gastrointestinal series was obtained and the presence of a diverticulum in the fourth portion of the duodenum was noted. (Fig. 3.) The remainder of the gastrointestinal tract was found to be normal. On January 23rd excision of the diverticulum was performed. (Fig. 4.) A sac filled with dark brown, thick material was noted. A pathologic report of "chronic inflammation in the mucosa of the diverticulum" was returned. The patient was placed on continuous gastric suction for a period of one week during which time her postoperative course was uneventful. After a day of surgical liquids the patient was placed on a soft diet. She has not experienced abdominal discomfort since suction was discontinued. By March 11th her appetite was better and she returned to work.

FIG. 3.

COMMENTS

The approach to diverticula of the third and fourth portions of the duodenum varies according to the relation of the diverticulum to the superior mesenteric vessels. If the diverticulum is to the right of the superior mesenteric vessels, the transverse colon should be retracted downward and the leaves of the transverse mesocolon entered from above. If the diverticulum is to the left of the superior mesenteric vessels, the transverse colon should be retracted upward and the base of the transverse mesocolon entered from below after the division of the ligament of Treitz.

The approach used in the second case is undoubtedly the best standard approach and would be the only one suitable in most cases. The diverticulum in the first case was in a bizarre position and was adjacent to the first portion of the duodenum and held in this position by vessels crossing its base. It is unlikely that the approach used in the first case would be suitable in any other case. The approach

FIG. 4.

used in the second case should be suitable for all diverticula of the third and fourth portions of the duodenum and well might be considered the standard approach. The incidence of diverticula of the fourth portion of the duodenum is not readily available, but it is certainly a rare condition. The indication for surgery is persistence of severe symptoms after careful exclusion of other possible causes. The removal of diverticula of the fourth portion of the duodenum is technically less difficult than those of the second portion.

Mahorner[5] has brought out that symptoms may be due to retarded emptying of the diverticulum because of fixation of the duodenum. It is probable that actual partial obstruction of the duodenum occurs after filling of the sac. The absence of a clearer cut relationship to eating is attributed to the filling of the sac with intestinal secretions.

Clinically, the patient presents symptoms simulating duodenal ulcer or cholecystitis, which may or may not be associated with eating. Moderate tenderness in the right epigastric region is usually the only physical finding. The diagnosis of duodenal diverticulum is difficult without roentgenologic demonstration. Conti, Foltz et al.[10] have demonstrated the presence of barium fluoroscopically as long as forty-eight hours following ingestion. They emphasize the necessity of ruling out the presence of pseudodiverticulum due to duodenal ulcer, congenital conditions distorting the duodenum and benign and malignant tumors.

Surgery is indicated only when symptoms become pronounced in spite of adequate and prolonged medical therapy, and after careful exclusion of other possibilities. It is sometimes safer to enter the duodenum to visualize the opening of the sac, especially where the biliary channels may be injured. Mahorner[5] has recently reported intubation of the common duct to insure further against injury.

SUMMARY AND CONCLUSIONS

1. Two cases of removal of the fourth portion of the duodenum are reported. One previous case was found in the literature.

2. A review of some of the clinical features of symptomatic diverticula is presented.

REFERENCES

1. SLATER, F. and PARSONS, W. H. The surgical aspects of diverticula of the duodenum. *South. Surgeon*, 14: 240, 1948.
2. MCQUAY, R. V. Duodenal diverticula and their surgical treatment. *Ann. Surg.*, 89: 36, 1929.
3. MORTON, J. J. The surgical treatment of primary duodenal diverticula. *Surgery*, 8: 265, 1940.
4. PEARSE, H. E. The surgical management of duodenal diverticula. *Surgery*, 15: 705, 1944.
5. MAHORNER, H. Diverticula of the duodenum and jejunum. *Surg., Gynec. & Obst.*, 85: 607, 1947.
6. MAHORNER, H. Diverticula of the duodenum. *Ann. Surg.*, 133: 697–707, 1951.
7. MINO, R. A. and LIVINGSTONE, R. G. A technic of exposure for diverticula of the third and fourth parts of the duodenum. *Ann. Surg.*, 129: 235, 1949.
8. BARNES, F. L. Diverticulosis of the duodenum. *Am. J. Surg.*, 20: 328, 1933.
9. FORRSELL, G. and KEY, E. Divertikel å pars descendens duodeni diagnosticeradt medels röntgenundeisökning och operativt aflägsnadt. *Nord. med. Ark.*, 48: 1, 1915.
10. CONTI, J. G., JR., FOLTZ, T. P. ET AL. Surgical and roentgenological aspects of duodenal diverticula. *J. A. M. A.*, 138: 403, 1948.

MECHANICAL INTESTINAL OBSTRUCTION

REPORT OF AN UNUSUAL CASE DUE TO MULTIPLE FOREIGN BODIES

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ALTHOUGH both gallstone ileus and ingested foreign body with their attendant intestinal obstruction occur not infrequently by themselves, we have been unable after searching the literature to uncover a case in which both conditions have obtained simultaneously in the same patient.

One of us (C. O. B.) recently admitted such a patient to University Hospital.

CASE REPORT

B. S., a sixty-seven year old white housewife, was admitted to University Hospital January 12, 1951, in severe distress with abdominal pain and vomiting. For several months this woman had been experiencing increasing constipation and associated "sticking" pain in the right lower quadrant with occasional melena. Three days prior to admission to the hospital she began to have emesis which rapidly became fecal in character. Abdominal pain, poorly localized, and increasingly severe distention followed along with obstipation. Twenty-four years previously an ovarian cyst had been removed, and a subsequent pelvic abscess had been drained by one of us (C. O. B.).

Physical examination showed an elderly white female complaining of severe but poorly localized abdominal pain. Her temperature was 100.8°F., pulse 112, respiration 21 and blood pressure 125/40. There was complete edentia. The abdomen was distended, tense, tympanitic and acutely tender to light palpation in the right upper and both lower quadrants. The white blood count was 17,000, with 88 per cent polymorphonuclear cells. The urine showed a trace of albumin and 1 plus sugar.

A preoperative diagnosis of perforated sigmoid diverticulum with associated obstruction was made. Accordingly, with the preparation of nasogastric suction and intravenous fluids the patient was taken to the operating room where under spinal anesthesia the abdomen was opened through a lower midline incision. The abdomen contained a large amount of pus with a distinct colon odor. The pelvis was then explored and the sigmoid was seen to be

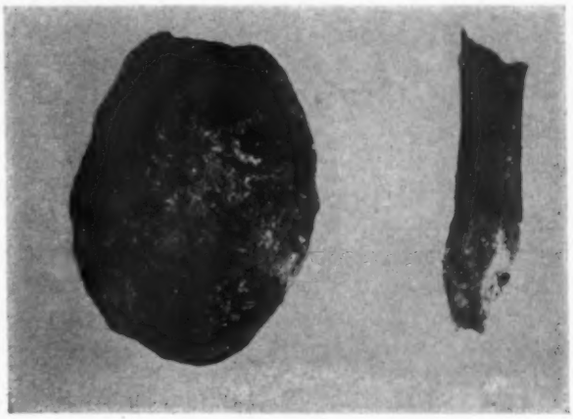

FIG. 1.

chronically indurated, scarred down and contained on its antimesenteric border considerable diverticula measuring in size from 2 mm. to 1 cm. In the sigmoid, just proximal to the rectosigmoid, was a free perforation of a diverticulum measuring 4 mm. in diameter. Extruding from the perforation was a foreign body (steak bone) shaped roughly elliptical. (Fig. 1.) Several loops of small bowel were caught in the pelvis and these were covered with a minimal amount of gray-green exudate. The upper jejunum was acutely dilated and the remainder of the small bowel distal to this was collapsed. At the site of the obstruction there was a large gallstone impacted within the upper jejunum which was roughly egg shaped. (Fig. 1.) The gallbladder was believed to be an atrophic structure and was intimately attached to the duodenum by a firm fibrous fistula. The steak bone was extracted, and the perforation in the sigmoid diverticulum was closed using an appendices epiploic tag. Jejunostomy was performed to recover the gallstone and was closed routinely. A cecostomy was then made and a large Penrose drain was inserted in the pelvic peritoneum.

The patient had an uneventful postoperative course and was discharged completely well on the twenty-sixth hospital day.

COMMENTS

Reconstructing the sequence of events in retrospect, it was believed that this elderly female had undoubtedly been afflicted with diverticulosis for a number of years; this is seen in her history of constipation and occasional lower cramping abdominal pain. She then, prior to her acute illness, inadvertently ingested a steak bone, which was in the process of being maneuvered through the flexures of the large bowel, when her solitary large gallstone passing from its cholecystoduodenal fistula lodged in and obstructed the upper reaches of the jejunum. With the acute upper intestinal obstruction and the subsequent rise of intraluminal and intra-abdominal pressure along with the forceful and prolonged emesis, the steak bone perforated the pre-existing sigmoid diverticulum before it could spontaneously complete its passage through the large bowel.

The incidence of gallstone ileus is reportedly low[1] and its presence is often disregarded in the diagnosis of intestinal obstruction. Perhaps 4 to 5 per cent of all cases of intestinal obstruction are secondary to gallstones lodged in the bowel. To Bartholin, who in 1654 recorded the first case, goes the credit for recognizing the clinical syndrome of gallstone ileus.

The sequence of events leading to gallstone ileus according to Broderick[2] is cholelithiasis, acute cholecystitis, gangrene, perforation of the gallbladder against the duodenum and pressure necrosis of the stone into the duodenum. It is believed that this process usually requires several days.

Most calculi will pass without event, but Wangensteen[11] states that those stones larger than a walnut (Foss, 2 to 3 cm.) tend to cause intestinal obstruction. Few stones will obstruct in the large bowel, the majority becoming impacted in the narrow reaches of the lower jejunum and ileum. Foss[3] reports only 3 per cent of intestinal obstructions due to gallstone ileus to be secondary to an impacted stone in the large bowel.

The diagnosis of gallstone ileus is best made by x-rays with the flat plate demonstrating a portion of the biliary system outlined by air.[1]

It is generally believed that although the incidence of gallstone ileus as a cause for intestinal obstruction is low, the condition carries one of the highest mortality rates of the various causes of acute bowel obstruction. This undoubtedly is due to the following facts:[3] (1) The obstruction although high is at first intermittent. (2) Patients, therefore, are often operated upon late, when they are gravely ill. (3) Gangrenous and/or perforated proximal bowel is usually present and this condition in itself undoubtedly raises the mortality rate. (4) The condition as an etiologic factor of intestinal obstruction is seldom recognized because of its infrequency.

Blain and Harkins[4] found in their series of cases that 38 per cent of all internal biliary fistulas led eventually to intestinal obstruction and that 40 per cent of all patients with gallstone ileus died. It is generally conceded[2] that in the presence of acute small bowel obstruction secondary to gallstone ileus the procedure of choice, even in the absence of gangrene, is to recover the stone from the bowel rather than attempt to delineate the cholecystenteric fistula. If, however, the impacted stone is seen to be faceted, there is little choice but to search for certain remaining stones in the biliary tree.

In contradistinction to gallstone ileus the incidence of known and inadvertent ingested foreign bodies must certainly be extremely high. The vast majority of these, however, pass without incident. Of 800 cases seen at the Boston City Hospital perforation occurred in only nine instances, an incidence of 1 per cent.[5] Perforating or obstructing foreign bodies then may be considered an infrequent cause of intestinal obstruction. The statement is often made in support of this contention that the most expedient way to collect a foreign body is with a bedpan.

Interestingly enough it is of little moment, according to Carp,[6] whether the foreign body is sharp or dull, for in his series 83 per cent of all sharp foreign bodies passed without incident while 79 per cent of all dull foreign bodies passed similarly. Snodgrass[7] concurs that 80 per cent of all cases of ingested foreign bodies pass spontaneously.

The etiology of ingestion of foreign bodies falls into several main categories: *Inadvertent:* The most prominent factor for the inadvertent ingestion of foreign bodies by the sane adult is the reduced buccal and pharyngeal sensitivity secondary to the wearing of dentures. *Careless-*

ness: Pre-school children not infrequently deliberately swallow foreign bodies. *Suicide:* Occasionally an attempt at suicide is made by the ingestion of several foreign bodies. *Insanity:* Schizophrenics often ingest fairly large quantities of bizarre and large foreign bodies.

Schantz[8] reported a case of a schizophrenic who presented himself with an acute condition of the abdomen. The correct preoperative diagnosis was made without benefit of x-ray, and at operation the stomach was found to contain two toothbrushes and an 8 inch square of moleskin. The jejunum had impacted within it two teaspoons, one toothbrush, matted wool fibers and one tongue blade. The appendix contained two nails and a piece of wood splinter.

Surprisingly, no part of the gastrointestinal tract escapes perforation by the foreign body and no definite conclusion can be drawn as to the site of predilection, but the flexures of the small and large bowel, pylorus, Meckel's diverticulum and small bowel confined in hernia sacs are more often the site of perforation.

The arrested foreign body causes an ulceration of the mucosa, and with continued pressure necrosis progressively involves succeeding coats of the bowel wall. Through this breech the intestinal contents and flora pass, giving rise to peritonitis, localization with gastrointestinal obstruction or generalized peritonitis.

The clinical picture as presented by Ginzburg[9] is varied. The syndromes may occur singly in or combination with the following depending upon the site and size of the perforation as well as the host resistance: (1) acute peritonitis, (2) localized intra-abdominal abscess, (3) intra-abdominal granuloma, (4) abscess of the abdominal wall, and (5) obstruction of the gastrointestinal tract secondary to peritonitis and abscess.

As previously stated, the great percentage of foreign bodies, whether metallic or sharp, pass naturally without event in five to seven days. Characteristically, the patient is entirely unaware of the occasion of having ingested a foreign body unless it lodges in the pharynx and causes choking. He therefore seldom presents himself after immediate ingestion but consults his physician only when an abdominal catastrophe has occurred. Indeed, often the patient never associates his immediate serious distress with such a previous minor incident or may fail entirely to recall the incident.

MacManus,[10] noting that the greatest incidence of ingested foreign bodies seemingly occurs in the third decade of life (fifty per cent of his cases), states that in only one case did the patient recall ingesting the foreign body and in only one case was the correct preoperative diagnosis made.

It might be well to reiterate the obvious fact that although the passage of most foreign bodies is without event, there are not an inconsiderable number of abdominal catastrophes secondary to impacted foreign bodies.

CONCLUSION

A case unique in the literature of mechanical obstruction due to gallstone ileus and a perforating steak bone is presented along with a brief review of the literature of some of the salient features of each condition.

REFERENCES

1. Lomhoff, I. and Dubowy, J. Gall stone ileus associated with diverticulitis of the colon. *Am. J. Roentgenol.*, 60: 86, 1948.
2. Denneen, E. V. and Broderick, T. C. Gall stone intestinal obstruction. *Ann. Surg.*, 131: 225, 1950.
3. Foss, H. L. and Summers, J. D. Intestinal obstruction from gall stones. *Ann. Surg.*, 115: 721, 1942.
4. Blain, A. and Harkins, H. N. Intestinal obstruction due to perforation of the gallbladder. *Surgery*, 21: 110, 1947.
5. Henderson, F. F. and Gaston, E. H. Ingested foreign bodies in the G-I tract. *Arch. Surg.*, 36: 66, 1928.
6. Carp, L. Foreign bodies in the intestine. *Ann. Surg.*, 85: 575, 1927.
7. Snodgrass, T. J. Foreign bodies in the intestinal tract. *Arch. Surg.*, 35: 441, 1947.
8. Schantz, B. and Kamil, R. S. Mechanical intestinal obstruction. *New York State J. Med.*, 47: 2605, 1947.
9. Ginzburg, L. and Beller, A. J. The clinical manifestations of nonmetallic perforating intestinal foreign bodies. *Ann. Surg.*, 86: 928, 1927.
10. MacManus, J. E. Perforations of the intestine by ingested foreign bodies. *Am. J. Surg.*, 53: 393, 1941.
11. Wangensteen, O. H. Intestinal Obstructions. Springfield, Ill., 1942. Charles C Thomas.

ARTERIOVENOUS FISTULA FOLLOWING HYSTERECTOMY*

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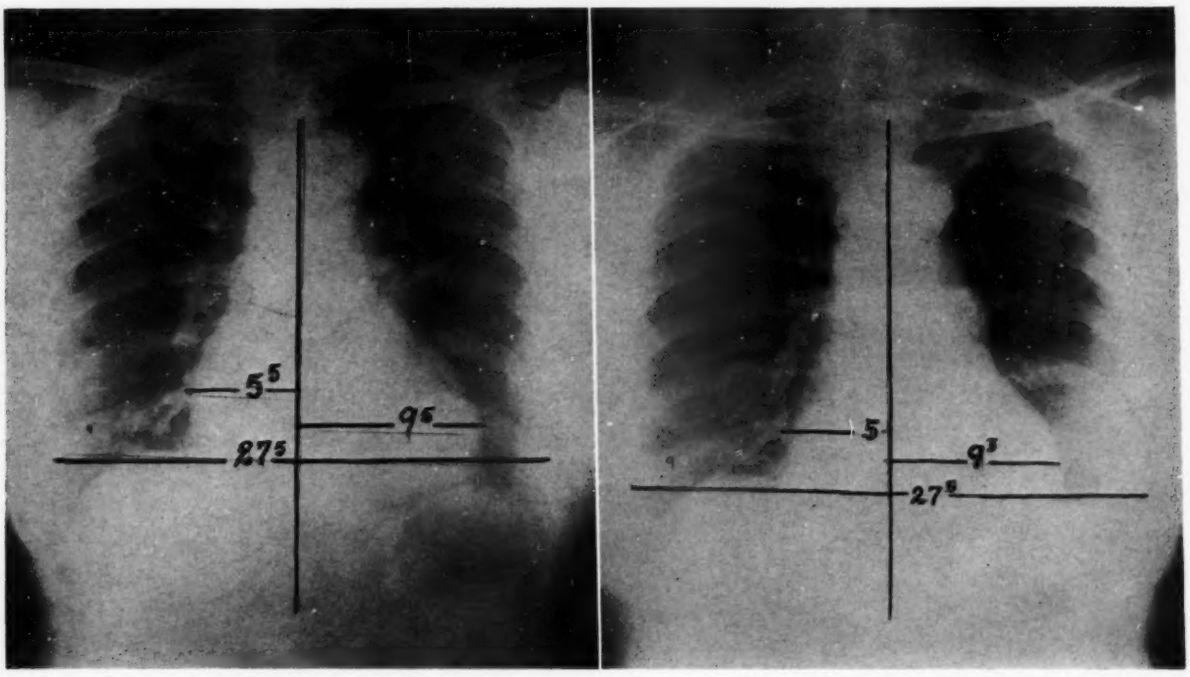
IT is generally recognized that trauma, particularly due to a penetrating object, is the most frequent cause of acquired arteriovenous fistulas. Seeley et al.[1] recently reported 101 such cases in war wounded individuals. It is not generally recognized, however, that these lesions can be the consequence of a surgical procedure.

William Hunter[2] in 1762 first reported the postsurgical development of an arteriovenous fistula. He described two cases following injury to the brachial vessels due to bloodletting, which was a common procedure at that time. Elkin[3,4] recently reported six cases of vascular damage subsequent to surgical intervention. In three of the reported cases arteriovenous fistulas developed and in the other three false arterial aneurysms developed. Stuart[5] reported the development of an arteriovenous fistula subsequent to the application of a Roger-Anderson splint. Gamm[6] and Elkin[3] reported fistulas following the insertion of a Steinmann pin. Reid and MacGuire[7] recorded the occurrence of arteriovenous fistulas subsequent to thoracentesis. This closely parallels the causative factors first reported by Hunter. Mora[8] and others[9,10] have reported arteriovenous fistulas involving the thyroid vessels following thyroid surgery. Linton and White[11] described such a lesion occurring between the right common iliac artery and the inferior vena cava following surgery for a ruptured intervertebral disc. Hollingsworth[12] reported a case involving the renal vessels.



1A 1B

FIG. 1. A, shows the cardiothoracic ratio in the preoperative chest film. B, demonstrates the change in this ratio with a diminution in the size of the cardiac silhouette; this film was taken six weeks after surgery.

From the foregoing citation of cases it can readily be seen that arteriovenous fistulas can develop in any portion of the anatomy where there are two vessels in juxtaposition. If these vessels are so traumatized that a communication or a potential communication

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is made to exist between them, then it may well be that a fistula will develop.

It is common procedure to secure bleeding vessels in a stump of tissue with a suture ligature. Such a procedure is particularly common in gynecologic operations. In most cases the ovarian and uterine vessels are secured with suture ligatures. A needle passed through a vascular bundle such as one commonly finds in ligating the infundibulopelvic ligament containing the ovarian artery and vein, and also in the uterine vessels, may pass through the vessels and give rise subsequently to a vascular lesion. The surgeon should make every effort to avoid injury to the vessels he is securing and, if possible, the vessels should be ligated individually.

It is not within the scope of this article to include the physiopathologic disturbances created by arteriovenous fistulas. It can be said, however, that patients showing cardiac hypertrophy and a hypertensive syndrome secondary to the development of the fistula usually respond quite favorably to surgical repair or excision of the fistula. Figure 1A shows the cardiothoracic silhouette of the case reported herein, one week prior to surgery. Figure 1B shows a chest roentgenogram taken six weeks after surgery. There is already a reduction in the cardiothoracic ratio.

The case reported herein involved the right ovarian artery and vein. In review of the modern literature the author was unable to find a similar case reported. Elkin[4] reported a case involving the uterine artery and vein.

FIG. 2. Shows a fuzzy outline of the fistula (arrow). This hazy outline was probably due to small vessels passing into the fistula that had picked up the dye. The diodrast had been injected through a polyethylene tube passed up in retrograde fashion through the right femoral artery; however, the level of instillation was too low for it to have been injected into the ovarian artery.

CASE REPORT

A. M. (No. A73461), a fifty-nine year old West Indian woman, entered the hospital with the chief complaint of pressure pain and fullness in the right lower side of the abdomen and transmitted through her vagina. She did not recall when these symptoms first began but stated that three weeks prior to admission the symptoms increased. She then sought admission to the clinic, with an exacerbation of the "pressure" symptoms. The pertinent data on the past history included a hysterectomy and appendectomy seventeen years previously. The patient had made an apparent complete recovery subsequent to surgery. Approximately three to four years ago she noticed that she could no longer climb stairs without becoming overly fatigued, and it became an effort to do what heretofore had been easy manual tasks. She consulted a physician who told her she had high blood pressure and treated her along this vein for the past four years.

Physical examination showed the following pertinent findings. The blood pressure was 200/120; pulse, 86. The lungs were clear to percussion and auscultation. The heart borders were moderately shifted to the left on percussion. No murmurs were heard. P_2 was louder than A_2. The liver was not palpably enlarged. There was a well healed lower midline scar. In the lower right quadrant a diffuse mass was felt which transmitted a definite bruit. The bruit was quite audible through the stethoscope and had a to and fro component. Bimanual pelvic examination revealed the presence of a cervix and a diffuse mass in the right adnexal region which could not be displaced from the cervix. The to and fro bruit was transmitted rather forcibly through the cervical stump. It was believed at this time that the patient had an arteriovenous fistula involving the

FIG. 3. Shows the arteriovenous fistula *in situ*. The pointer demonstrates the greatly enlarged ovarian vein. The tortuous structure immediately above the vein is the enlarged ovarian artery.

FIG. 4. Demonstrates the arteriovenous fistula after having been dissected from the stump of the cervix. Note the tremendous enlargement of the vein and the tortuosity of the artery.

right uterine artery and vein. Accordingly 70 per cent diodrast was instilled through a polyethylene tube which had been passed in retrograde fashion from femoral artery up to the bifurcation of the aorta. A fuzzy outline of the fistula was demonstrated. (Fig. 2.) The sparcity of the dye in the arteriovenous fistula was thought perhaps to be due to a faulty rate of injection.

Laboratory data included a negative blood

FIG. 5. Demonstrates the existing aperture between the artery and vein.

Hinton test. Red blood count was 5.3 million per cc.; hemoglobin, 15.7 gm. per cent; blood sugar 93 mg. per cent; urea nitrogen 15.9 mg. per cent; plasma proteins 8.85 mg. per cent with a 1.03/1.0 A/G ratio. Prothrombin time was 16, control 16; cholesterol 390 mg. per cent, esters 195 mg. per cent. White blood count was 6,500 with a normal differential. Urine analysis 1.018 specific gravity with a 1+ albumin. Electrocardiogram revealed a pattern of left ventricular hypertrophy and strain.

The patient was operated upon on March 26, 1952. Anesthesia consisted of cyclopropane-oxygen-ether. The abdomen was entered through a lower midline incision excising the old scar. The mass of tortuous pulsating vessels was identified in the right lower quadrant, immediately adjacent to the cervical stump. (Fig. 3.) Before attempting to isolate the fistula, traction tape was placed around the common iliac and the internal and external iliac vessels for safety purposes. Compression of the internal iliac artery failed to collapse the fistula at all. It then became apparent that we

were dealing not with a uterine artery-vein fistula but probably with one involving the ovarian vessels. The peritoneum over the lateral gutter was then incised and the cecum and ascending colon were mobilized. The right ureter was identified and carefully preserved. By tedious dissection the origin of the ovarian artery off the aorta and the entrance of the ovarian vein into the vena cava were identified and traction tapes placed around these points. The fistula was then dissected away from the cervical stump. The artery was approximately 1½ cm. in diameter, and the vein was about 2½ cm. in diameter. (Fig. 4.) In dissecting the fistula away from the cervical stump several small vessels feeding directly into the fistula had to be ligated. (It is most likely that these vessels provided the avenue of entrance for the injected diodrast in the preoperative arteriogram.) The arteriovenous fistula was then dissected up to its point of entrance and exit, where the artery and vein were doubly ligated with No. 00 silk. The colon and cecum were then replaced and the lateral peritoneal gutter restored. The patient made an uneventful recovery.

Figure 5 shows the aperture joining the artery and vein. Postoperatively the patient's cardiac status improved steadily and a chest x-ray six weeks postoperatively revealed an improvement of the cardiothoracic ratio. Six months after surgery the patient stated that she noticed marked improvement in her work status and no longer had the exertional dyspnea that plagued her before corrective surgery.

SUMMARY

1. Acquired arteriovenous fistulas are commonly caused by traumatic penetrating objects. It is not generally known that arteriovenous fistulas may be a complication following a routine surgical procedure.

2. A review of some of the cases reported in the literature is presented.

3. A review of the literature failed to produce a case of an arteriovenous fistula involving the ovarian artery and vein, as reported herein.

4. A case of an arteriovenous fistula involving the right ovarian artery and vein seventeen years after supracervical abdominal hysterectomy is reported. A surgical cure is obtained.

REFERENCES

1. Seeley, S. F., Hughes, C., Cook, F. and Elkin, D. C. Traumatic arteriovenous fistulas and aneurysms in war wounded. *Am. J. Surg.*, 83: 471, 1952.
2. Hunter, W. Observations upon a particular species of aneurysms. *Med. Obs. Soc. Phys. Lond.*, 2: 390, 1762.
3. Elkin, D. C. and Banner, E. A. Arteriovenous aneurysm following surgical operations. *J. A. M. A.*, 131: 1117, 1946.
4. Elkin, D. C. Aneurysm following surgical procedures: report of five cases. *Ann. Surg.*, 127: 769, 1948.
5. Stuart, D. W. Arteriovenous aneurysm following amputation. *Brit. M. J.*, 2: 346, 1929.
6. Gamm, K. E. Arteriovenous fistula. *J. A. M. A.*, 124: 1128, 1944.
7. Reid, M. R. and MacGuire, J. Arteriovenous aneurysm. *Am. J. Surg.*, 108: 643, 1938.
8. Mora, J. M. Arteriovenous aneurysm of left superior thyroid vessels. *Surg., Gynec. & Obst.*, 48: 123, 1929.
9. Selman, J. J. and Freedlander, S. O. Arteriovenous aneurysm of thyroid vessels. *Am. J. Surg.*, 17: 99, 1932.
10. Ransohoff, J. L. Arteriovenous aneurysm of the superior thyroid artery and vein. *Surg., Gynec. & Obst.*, 61: 816, 1935.
11. Linton, R. R. and White, P. D. Arteriovenous fistula between the right common iliac artery and inferior vena cava. *Arch. Surg.*, 50: 6, 1945.
12. Hollingsworth, E. W. Arteriovenous fistula of the renal vessels. *Am. J. Med. Sc.*, 188: 399, 1934.

ANEURYSM OF THE LATERAL PLANTAR ARTERY

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CONSIDERING the frequency with which children run around barefooted and stick things in their feet, it seems surprising that damage to the vessels on the plantar surface are not fairly frequent. True, the vessels are of small size and are protected by the thick plantar fascia. Yet a perusal of the Index Medicus for the past fifteen years has failed to uncover a single instance of aneurysm of a plantar artery, and only a single instance[1] of arteriovenous fistula was found and this following surgery on the foot. It is known that many cases go unrecorded or unreported, yet the fact that recorded cases are practically non-existent certainly indicates a relative infrequency. The recording of a case of traumatic aneurysm of the lateral plantar artery therefore seems justified because of: (1) its rarity; (2) the possibility of it being overlooked as a cause for foot pain; and (3) the problem of surgical approach to such an aneurysm.

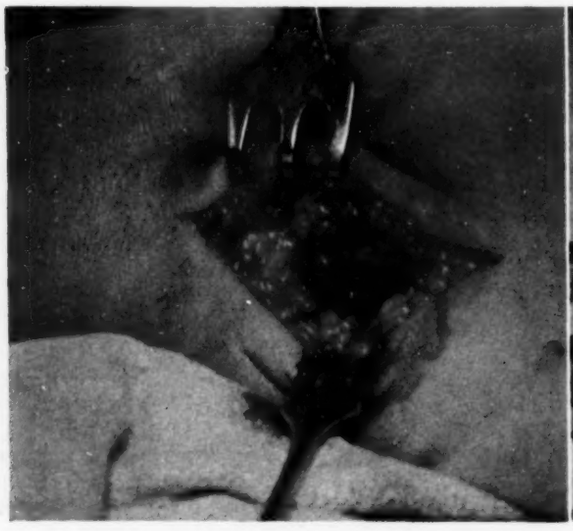

FIG. 1. Aneurysmal sac lateral plantar artery.

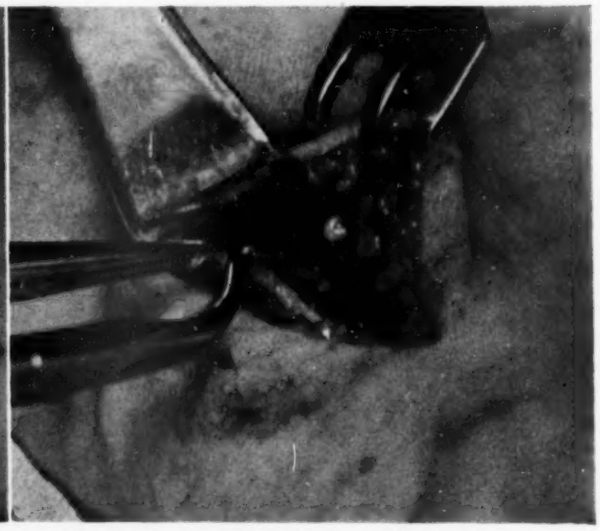

FIG. 2. Afferent and efferent arterial limbs. Forceps on ruptured sac.

CASE REPORT

The patient, a nine year old white girl, was first seen because of pain in the sole of her left foot when she walked. Two months previously she had stepped on a piece of glass, cutting the sole of her foot. She was treated at home with a pressure dressing applied by her mother to control the bleeding, was not seen by any doctor and received no antibiotics or antiserum. Healing apparently occurred promptly but three weeks prior to first consultation she began to complain of pain on weight bearing and the sole of the foot was tender. When examined there was no immediately apparent cause seen. A 1 inch scar was present just medial to the midline of the sole of the left foot at the junction of its posterior and middle thirds. There was a suggestion of a slight bulge only. Palpation revealed a thrill and suggestive expansile tumor and a systolic bruit was plainly audible over the scar. Both the dorsalis pedis and posterior tibial arteries were palpable, graded 4. No difference in skin temperatures of the two feet was present and no discoloration or trophic changes noted. A diagnosis of aneurysm of the lateral plantar artery seemed inescapable, and on November 26, 1952, the foot was explored. There seems to be an unnecessary objection to placing scars on the sole of the

foot; on completely weight-bearing areas this may be extremely annoying, but elsewhere they are well tolerated. Certainly to treat such a lesion as this a direct approach over the disorder seems less traumatic and allows better exposure. Under tourniquet an incision was made through the scar and an aneurysmal sac demonstrated. (Fig. 1.) Dissected up, it was possible to demonstrate the proximal and distal arterial limbs (Fig. 2) with no venous attachment. The plantar nerve was adjacent, and apparently cause of the pain was pressure on the nerve by the enlarging false aneurysmal sac. Excision of the sac was carried out and convalescence and recovery were prompt and satisfactory.

SUMMARY

A case of aneurysm of the lateral plantar artery is recorded.

REFERENCE

1. Coughlin, J. J. Arterio-venous aneurysm of the foot following plantar fasciotomy. *Northwest Med.*, 50: 772, 1951.

I. Amreich believes chronic endocervicitis, cervicitis, chronic erosion of cervix, cystic degeneration or leukoplakia of the cervix as well as cervical polyps may all be precancerous. He therefore recommends prompt surgery to remedy these conditions. He also thinks diagnostic dilatation and curettage is indicated in patients having a delayed climacterium and in those patients with hyperplasia of the uterus because their cells, in the stage of division, are especially susceptible to carcinogenic agents. (*Richard A. Leonardo, M.D.*)

HEMATEMESIS OF UNUSUAL ETIOLOGY*

CASE REPORT OF MESENTERIC THROMBOSIS WITH RECOVERY

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PROFUSE hematemesis is a medical and surgical emergency. When a patient has a past medical history of peptic ulcer, management is simplified. However, there are other causes for gastrointestinal bleeding. Among these are: (1) hemorrhagic blood diseases; (2) esophageal abnormalities including varices, hiatal hernia and carcinoma; (3) gastritis and benign or malignant ulcers of the stomach; (4) pancreatic inflammation or malignancy; (5) Meckel's or other diverticula of the intestines, including congenital "rests" and reduplications; (6) mesenteric vascular occlusion; and (7) diseases of colon and rectum including neoplasm and ulcerative colitis.[8]

Lesions of small and large bowel are more likely to be accompanied with melena than with hematemesis. Nevertheless in the presence of partial, incomplete intestinal obstruction it is possible for hemorrhage distal to the duodenum to be manifest as acute profuse hematemesis. One case was observed recently.

CASE REPORT

W. L., a thirty-four year old white man generally in good health, had noted anorexia on November 20, 1952. He continued eating, however, favoring a milk diet. Bowel movements were satisfactory that day and the next. Towards evening of November 21st the patient had upper abdominal pain radiating from the epigastrium bilaterally along the costal margins.

Examination at this time revealed normal temperature, pulse, respirations and blood pressure. Physical findings were normal. On abdominal examination there was hyperactive peristalsis, no tenderness, no rigidity nor rebound phenomona.

The patient was given mild analgesia and instructed to follow a bland diet. During the next day abdominal discomfort and anorexia persisted. There was satisfactory response to an enema.

During the next night (November 22nd) epigastric pain increased and by the following morning severe, crampy, lower midline abdominal pain was present. At this time the patient was unable to retain food or liquids. Vomitus was clear and described as colorless. On the afternoon of the third day of illness he was referred for hospitalization.

Review of past medical history demonstrated a similar episode one year previously. This had subsided after three days. In addition six months previously the patient had noted, during a three- or four-day period, that his stools were pitch black in color. There had not been any episodes of severe indigestion although on occasion he did take a mild alkaline powder.

The patient recalled having lunch at a restaurant two weeks previously (November 10th) where the ice cream he had eaten contained glass.

He was a mechanical engineer, his work being sedentary. There was no contact with toxic agents. He had no injuries,[4] allergy or any illness while in military service.

Family history was non-contributory except that his father had died following gastric hemorrhage presumably from "ulcer" disease.

The patient had walked into the hospital. He was a well proportioned, muscular young man. No pallor, jaundice, edema or dyspnea was present. There was a dusky tint to his lips and nail beds. Temperature, pulse, respirations and blood pressure (135/90 mm. of Hg) were normal. Head and neck, heart and lungs were normal. Abdomen was slightly distended. There were no signs of hernia. Liver and spleen were not palpable. There was moderate bilateral costovertebral angle tenderness, greater on the left. Diffuse tenderness was present in the epigastrium. Rebound phenomona, although minimal, were generalized. Peristalsis was quiet but audible. There was a soft, rounded mass in the left hypochondrium approximately 6 cm. in diameter. The upper edge of this mass merged into the left costal margin; the lower edge was

* From the Surgical Service of the Albert Einstein Medical Center (Northern Division), Philadelphia, Pa.

at the level of the umbilicus. The mass was movable but not tender. Rectal examination was normal although feces were not present. Neurologic examination was normal.

Complete blood count was reported as follows: red blood cells, 5.5 million; hemoglobin, 16.7 gm. per cent; white blood cells, 23.4 thousand. Serum amylase was 140 units (Somygi). Urinalysis was normal. Radiographic examination of the abdomen revealed a few distended loops of small bowel but with gas present in the stomach and in the entire colon.

Clinically, it was believed that this patient had a subsiding acute pancreatitis. Conservative management followed.

A Cantor tube was passed. Oral feedings and opiates were denied the patient. Parenteral fluid was given. Papaverine (130 mg.) and atropine sulfate (0.5 mg.) were administered hypodermically every four hours.

On the following morning the patient complained of marked weakness and nausea. Drainage from the Cantor tube was thick and positive for occult blood. Re-examination of the abdomen by x-ray showed a slight increase in accumulation of small intestinal gas. In the course of an hour after x-ray examination the patient vomited about 1,500 cc. of coffee-ground material together with the Cantor tube. A Miller-Abbott tube was passed. After a few hours the patient regurgitated this tube also with about 2,000 cc. of coffee-ground vomitus. Each episode of vomiting was followed by nearly complete subsidence of symptoms. A Levine tube was passed and attached to suction.

In the afternoon the patient was sent to the x-ray department for re-examination. During fifteen to twenty minutes nearly 1 L. of blood and bloody fluid poured in a steady stream from the nasogastric suction tube. The patient's pulse rate rapidly increased, blood pressure dropped and he approached a state of hemorrhagic shock.

He was taken directly to the operating room. Blood was administered rapidly, preoperative medications and other preparations completed.

Examination of the radiographs taken at the time of this profuse hematemesis revealed a classic pattern of marked small bowel distention. Several layers of gas which could not be identified were present below the "stepladder pattern."[5] Gas was present in the colon at this time. (Fig. 1.) A preoperative diagnosis was not made.

FIG. 1. X-ray study of abdomen at time of massive hematemesis. Gas is present in all segments of intestine from stomach through rectum; marked distention of small bowel in upper abdomen; gas-filled loops of irregular pattern in mid-abdomen are the gangrenous loops of bowel.

The patient was placed under closed circle cyclopropane, intravenous pentothal,® succinylcholine and nitrous oxide anesthesia in the dorsorecumbent position. Incision combined a left paramedian with a right transverse incision; the right rectus muscle was cut about 2 inches above the umbilicus. After opening the peritoneum a moderate quantity of sanguineous fluid was seen. The palpable mass was identified as fatty omentum overlying distended small bowel. Exploration revealed a 6 foot segment of small bowel to be gangrenous. This was resected and viable bowel joined by side-to-side anastomosis. Liver and spleen were normal to palpation.

Examination of the resected specimen revealed the mucosa of the bowel to have many areas of gangrenous ulceration from where the bleeding originated. There was thrombosis of the mesenteric veins. The mesenteric arteries were normal. Vascular sclerosis was not present.[2]

The patient's convalescence was uneventful. Depoheparin® was used to maintain the clotting

time between twenty-five and thirty minutes for the first four postoperative days. After the fifth postoperative day and in the presence of active peristalsis, dicumarol and oral terramycin were begun. During the sixth and seventh postoperative days the patient had a profusion of diarrheal movements which subsided spontaneously. He was discharged from the hospital on the tenth postoperative day.

After his discharge from the hospital the patient's convalescence was uneventful, except for slight hypertension which soon subsided. Dietary intake and bowel movements were normal. There was neither abdominal pain nor tenderness. The abdominal incision healed well.

Because of slight hypertension and the increased number of red cells observed several times during hospitalization, hematologic studies were pursued to determine the presence of polycythemia as a possible cause for the mesenteric thrombosis. However, blood counts

Date	Hemoglobin (gm. %)	Red Blood Count	White Blood Count
12/23/52	100%	5,300,000	12,000
1/12/53	98%	5,000,000	6,600

were normal. Differential counts were normal.

The patient returned to full activities and has been asymptomatic to date. His general condition is excellent. Blood pressure now is within normal limits (February, 1953).

COMMENTS

In retrospect this patient presented a clinical picture of incomplete intestinal obstruction[1] gradually progressing towards total bowel stoppage.[7,9] There was evidence of an associated vascular accident. Even though the patient was younger than the usual patient with mesenteric occlusion and even though hematemesis pointed toward the stomach or duodenum, in hindsight the preoperative diagnosis could have been properly made.[6]

The use of anticoagulants in his postoperative period is considered essential.[3]

It is possible that the patient has polycythemia vera[1] but the diagnosis cannot be corroborated at this time.

There was no clinical or pathologic cause identified in this case to account for the mesenteric occlusion. The massive hematemesis originated in the area of gangrenous bowel. Since the arterial supply was intact, the bleeding occurred through areas of necrosis in the gangrenous segment.

SUMMARY

A case of a thirty-four year old white man who had acute mesenteric thrombosis with gangrene of 6 feet of bowel presented massive acute hematemesis as one of the major symptoms. Following surgical treatment, the patient recovered.

REFERENCES

1. Bockus, H. L. Gastroenterology, vol. 1, pp. 574–575. Philadelphia, 1946. W. B. Saunders Co.
2. Carucci, J. J. Mesenteric vascular occlusion. *Am. J. Surg.*, 85: 47–54, 1953.
3. Knepper, P. A., McDaniel, J. R., Brooker, R. M. and Neudorf, L. G. Primary mesenteric thrombosis treated with resection and anticoagulants. *Am. J. Surg.*, 80: 937–940, 1950.
4. McCune, W. S., Keshishian, J. M. and Blades, B. B. Mesenteric thrombosis following blunt abdominal trauma. *Ann. Surg.*, 135: 606–615, 1952.
5. Rendick, R. A. and Harrington, L. A. Roentgenologic observations in mesenteric thrombosis. *Am. J. Roentgenol.*, 52: 317–322, 9144.
6. Rhoads, J. E. In: Bockus, H. L. Gastroenterology, vol. 2, pp. 933–935. Philadelphia, 1946. W. B. Saunders Co.
7. Storer, J., Kazdan, P. and Bilton, J. L. Venous mesenteric thrombosis. *Am. J. Surg.*, 84: 636–640, 1952.
8. Vaughan, A. M. The acute abdomen. *Am. J. Surg.*, 47: 602–611, 1940.
9. Warren, S. and Eberhard, T. P. Mesenteric vascular thrombosis. *Surg., Gynec. & Obst.*, 61: 102–121, 1935.
10. Wangensteen, O. H. In: Christopher, F. Textbook of Surgery, pp. 1056–58. Philadelphia, 1945. W. B. Saunders Co.

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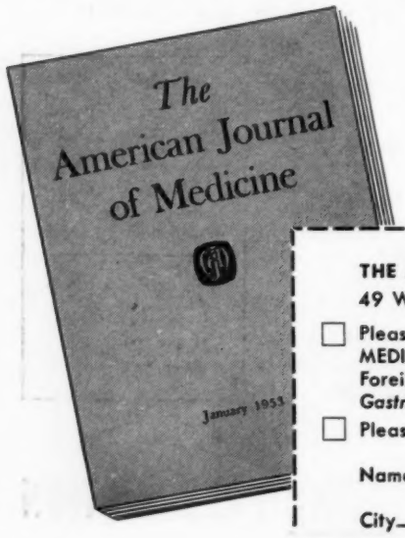

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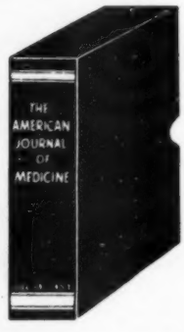

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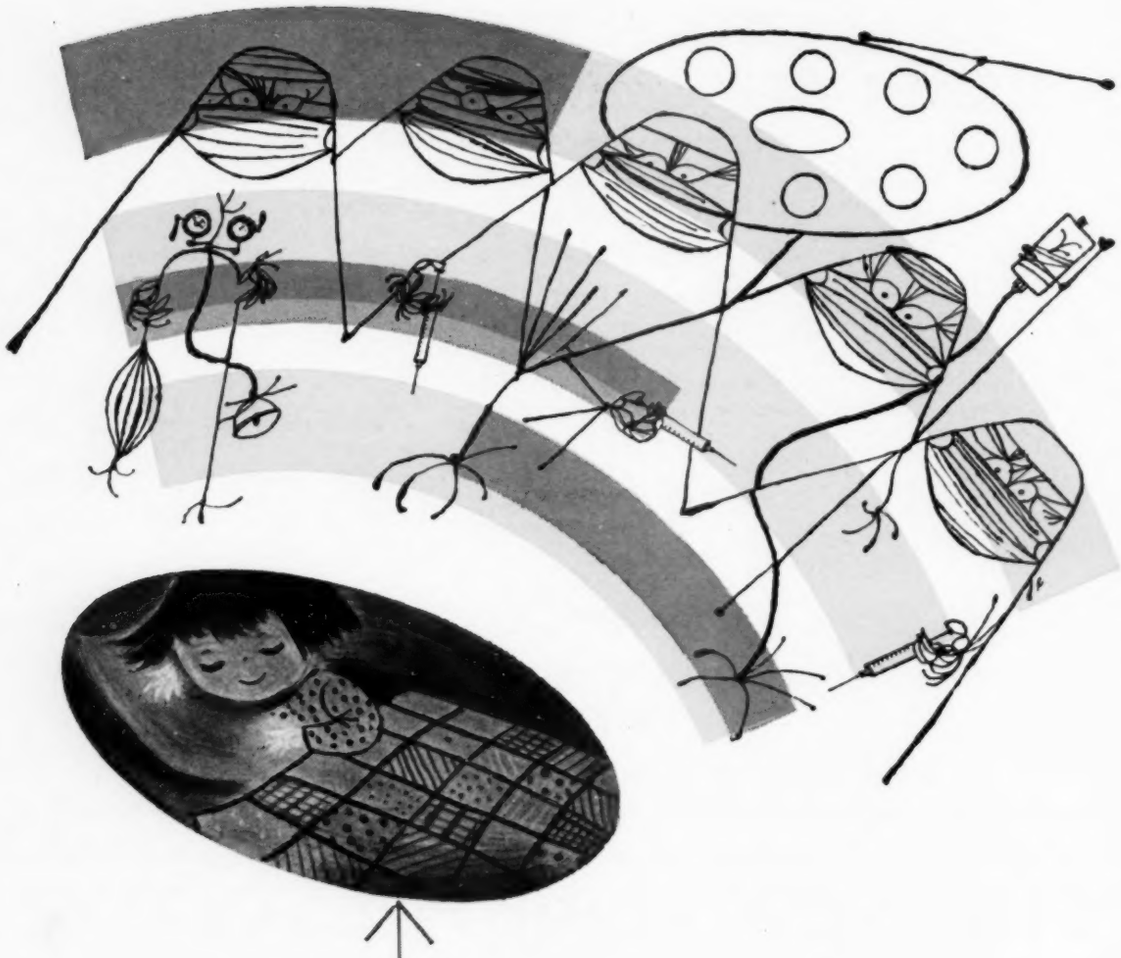

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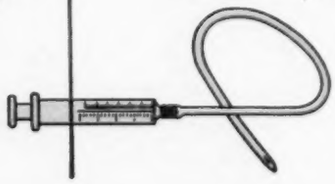

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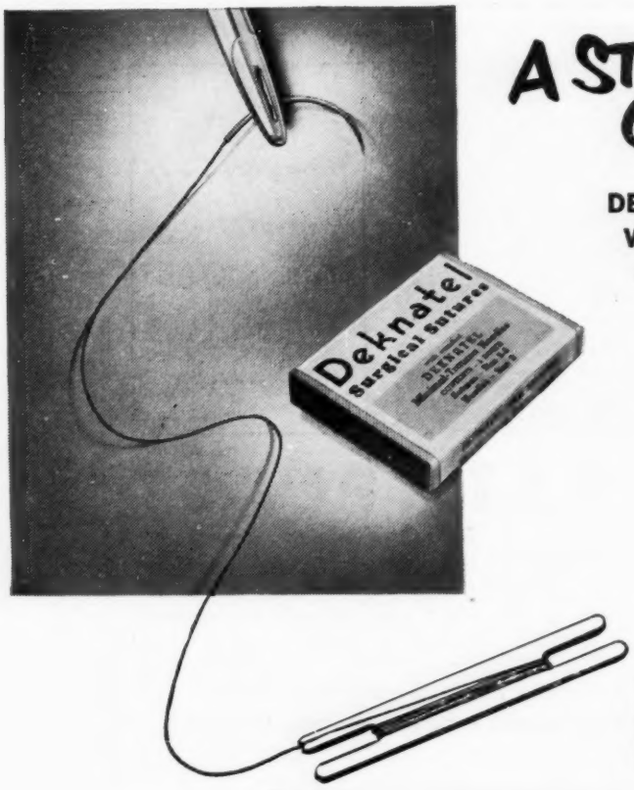

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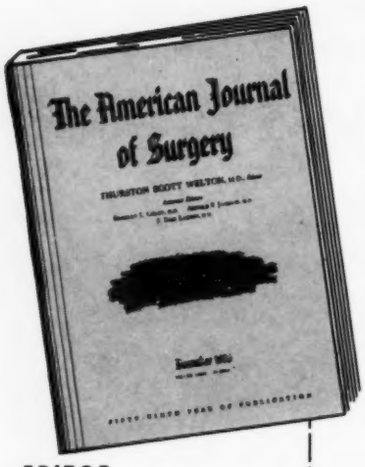

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This volume (we read on the jacket) marks the beginning of a new series. The plan is to publish in the course of the next few years several additional volumes of The Ciba Collection of Medical Illustrations. The next volume will have some 230 illustrations of the male and female reproductive system. Issued in book form these are offered at cost. It is a non-profit publication. The book may be obtained by writing to the Publications Department, Ciba Pharmaceutical Products, Inc., Summit, New Jersey. Payment of $6.00 must be received with the order.

THE drug industry has earned praise for helping make possible the present "age of wonder drugs" and for its contributions in conquering disease during the last fifty years, the American Pharmaceutical Manufacturers' Association was told. Credit for the discovery of many new medicines can be traced to the increasingly important emphasis placed on research by the pharmaceutical business, according to Dr. Theodore G. Klumpp, President of Winthrop-Stearns Inc., pharmaceutical manufacturer. He addressed the A.P.M.A's forty-sixth annual convention at the Greenbrier Hotel, White Sulphur Springs, W. Va.

"We can't make much progress if we have only one, two or three bright young scientists shut up in a laboratory, puttering along on problems as vital as health and life. The sooner we realize that the day of the brilliant individual investigator working alone in a hermetically-sealed compartment is gone forever, the sooner will we solve problems that are far more important than nylon stockings, synthetic rubber, or the tensile strength of steel. Progress in the future will come increasingly from the collaborative efforts of chemists, physicists, physiologists, pharmacologists and clinicians."

THE American College of Cardiology held its second annual meeting at the Statler Hotel in Washington, D. C., on June 7, 8 and 9, 1953. Dr. Joseph Burton Glenn, President of the Washington Chapter of the American College of Cardiology, was inducted as Chairman of the Board of Governors. Admiral George W. Calver, Physician to Congress, and Dr. Irving Brotman, Secretary and Treasurer of the Washington Chapter, were elected to the Board of Trustees.

DR. Herbert S. Gasser will retire in July as Director of The Rockefeller Institute for Medical Research after more than seventeen years' service. Dr. Gasser, who has reached retirement age, received with Joseph Erlanger in 1944 the Nobel Prize for their discoveries concerning the differentiated functions of nerve fibers. Dr. Gasser succeeded Dr. Simon Flexner as the second Director in the history of the Institute.

(continued on page 44)

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Outside the Ivory Tower

(continued from page 42)

THE Art Directors Club of New York has honored Abbott Laboratories for four pieces of advertising art which appeared during 1952. Abbott was the only pharmaceutical manufacturer to win an Art Directors Club Medal. This was for the painting by Robert Philipp which appeared on a direct mail broadside advertising Selsun Suspension to the medical profession.

AN Act of Congress has provided that Colonel James C. Kimbrough, M.C., Chief of Urology Service in Walter Reed Army Medical Center's hospital component, will remain as a consultant to the staff of Walter Reed Army Hospital upon his retirement scheduled for August 31st. This Act states, "To giver proper recognition to the distinguished service Colonel Kimbrough has made to the science of medicine and surgery, and in order to provide that his mature professional judgment and long experience may continue to remain available to the public service, the President hereby authorizes designation of Colonel Kimbrough, upon his retirement from the active list, as consultant in Urology at Walter Reed Army Medical Center, Washington, D. C."

THE Second International Congress of Cardiology will be held in Washington, D. C., September 12–15, 1954. It will be immediately followed by the Annual Scientific Sessions of the American Heart Association, September 16–18, 1954. The opening session will be held in the auditorium of Constitution Hall at 10:30 A.M. on Sunday, September 12, 1954, with addresses of welcome. A reception will be given at the Mayflower Hotel at 5:00 P.M. on the same day for all members of the Congress and their families. A banquet will be held September 15, 1954 at 7:30 P.M.

THE Eighteenth Annual Congress of the United States and Canadian Sections of the International College of Surgeons will open at the Waldorf-Astoria in New York on Sunday evening, September 13th, with a session open to the public on the "International Surgeons' Hall of Fame" with Dr. Richard H. Shryock, Director of the Institute of the History of Medicine of Johns Hopkins University, Baltimore, speaking on "Fame in Surgery." The scientific program will open on Monday morning, September 14th, with a session on "Advances in the Treatment of Cancer," with Drs. Charles S. Cameron of the American Cancer Society, Cornelius P. Rhoads of the Sloan-Kettering Institute for Cancer Research, George N. Papanicolaou of Cornell University Medical College, T. A. Watson of Cancer Services for Saskatchewan, Komei Nakayama of Chiba (Japan) University Medical School, and George J. Papayannopoulos of Athens, Greece, among the speakers.

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WITHIN recent months efforts have been under way to increase the exchange of information in the field of tissue transplantation among investigators in laboratories and those at the bedside. The USPHS sponsored a small conference which took place in October, 1952, at Arden House, Harriman, New York. At this conference workers in plastic surgery, cancer, zoology and other fields discussed common problems in tissue transplantation. In March, 1953, the Ciba Foundation sponsored a similar conference in London, England, which emphasized the "Preservation of Normal Tissues for Transplantation." Participants at both conferences believed that some means should be provided for further continuous exchange of information on an informal basis among investigators in the clinic and the laboratory interested in problems of tissue transplantation. To meet this need it was proposed to issue a quarterly "Transplantation Bulletin."

The Transplantation Bulletin hereby extends an invitation to all workers in the fields of medicine and biology interested in tissue transplantation to submit their name and field of interest to E. J. Eichwald, M.D., University of Utah Col-

(continued on page 46)

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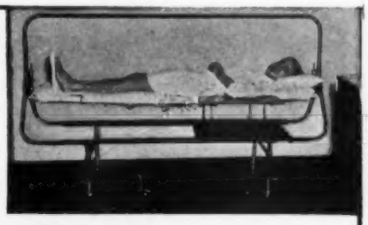

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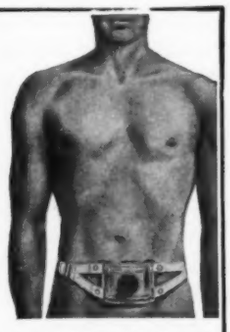

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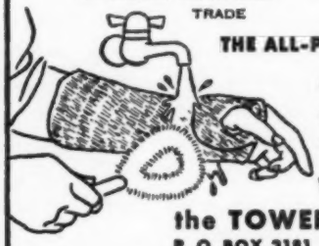

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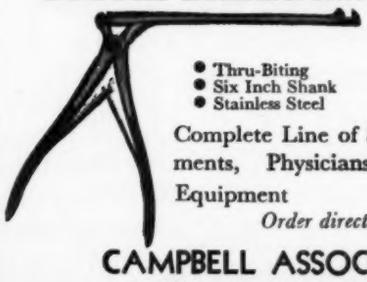

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Outside the Ivory Tower

(continued from page 44)

lege of Medicine, Salt Lake City, Utah. A subscription fee of $3.00 to cover the expenses of printing the Bulletin and maintenance of the Registry and bibliography, will be payable after the first issue of the Bulletin has appeared. The first issue is expected to appear in August, 1953.

MEDICAL school responsibility to the community necessitates increased attention to public attitudes, writes D. Lincoln Williston, manager of the office of public information at the University of Illinois Professional Colleges, in an article in the May issue of *The Journal of Medical Education*. With the expansion of medical schools in an increasingly complex society, problems can arise when people do not understand the job the medical school is doing. False impressions can be corrected by a conscientious effort on the part of the schools to improve their relations with their publics—students, their families, the community, governmental representatives and the public served by medical school graduates.

Some of the difficulties encountered by medical schools have resulted from a lack of understanding of just what public relations is and is not. "Public relations," writes Mr. Williston, "is an operating philosophy that must permeate the entire organization from the chairman of the board of trustees to maintenance personnel on the midnight shift." He stresses the importance of two-way communication—from the public, so that the school will understand public attitudes, and from the school to help the public gain a correct understanding of the institution they help support.

CEREMONIES at Philadelphia General Hospital honoring the late Sir William Osler were highlighted by presentation of the painting, "Osler at Old Blockley," to the hospital by Dr. George E. Farrar, Jr., medical director of Wyeth Laboratories. The painting, by Dean Cornwell, N.A., is one of the "Pioneers of American Medicine" series commissioned by Wyeth to depict great moments in the history of medicine in this country.

Cornwell's painting captures Sir William in a typical mood, chatting with an infirm woman in the hospital yard—accompanied by interns as usual—while on his way to the old post house, which can be seen in the background. The post house is now the Osler Memorial and Blockley Historical Museum, in which the painting will be hung.

Alfred G. Scattergood, President of the Philadelphia General Hospital Board of Trustees, accepted the painting from Dr. Farrar, during ceremonies on June 5th. Dr. August H. Groeschel, Executive Director of the hospital, presided over the ceremonies.

A NEW catalog, issued by American Sterilizer Company, Erie, Pa., describes the latest procedures in the sterilization of pharmaceuticals, packaged food products, surgical dressings and bulk product materials such as wools, synthetic fibers, seeds, tobacco, etc. Recent developments in drugs and materials which are heat and moisture sensitive have made sterilization by steam or hot air undesirable. American meets these conditions with a cold process which utilizes "carboxide" gas as the sterilizing agent. Plastic and rubber products, powders, delicate instruments, safety equipment, packaged dry goods and foods, and pharmaceuticals are presently using this American cold process. To meet a wider application American has introduced a combination steam-"carboxide" sterilizer.

THE general oral and pathology examinations (Part II) were conducted at the Edgewater Beach Hotel, May 17 through May 24, 1953, at which time 315 candidates were certified. The next scheduled examination (Part I), written examination for all candidates will be held in various cities of the United States and Canada on Friday, February 5, 1954.

All candidates for admission to the examinations for certification by the Board are required to submit with their application a plain typewritten list of all patients admitted to the hospitals in which they practice, for the year preceding their application or the year prior to their request for reopening of their application, with the diagnosis, pathologic diagnosis, nature of treatment and end result. Twenty-five case abstracts are due immediately after notification of eligibility and are to be sent by the candidate to the Secretary.

Attention of all candidates is called to a change in date. Application for examination or re-examination, as well as requests for resub-

(continued on page 48)

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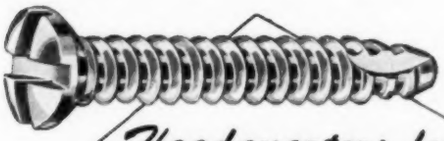

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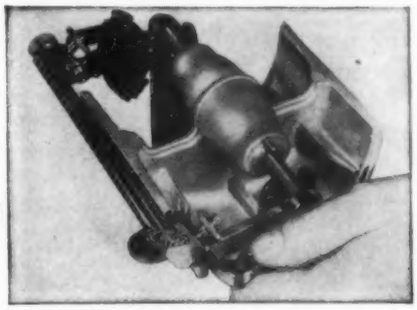

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Outside the Ivory Tower

(continued from page 46)

mission of case reports, must be made to the Secretary prior to October 1, 1953.

Requests for application forms for Appraisal of Incomplete Training, for Certification, and Bulletins should be accompanied by a large stamped, self-addressed envelope and mailed to:

Robert L. Faulkner, M.D., Secretary
American Board of Obstetrics and Gynecology
2105 Adelbert Road
Cleveland 6, Ohio.

A SERIES of short courses in radiologic health are again being presented by the Public Health Service at the Environmental Health Center in Cincinnati, Ohio. These courses, tuition free, are designed primarily to provide professional personnel working in health departments and other organizations with a working knowledge of the health hazards associated with radiation. Candidates should have a degree in medicine, engineering or science (physical or biological). Instruction is given in radiation physics sufficient for an understanding of the problems arising from proper and improper use of ionizing radiation. Laboratory and lecture periods are presented covering the hazards, and methods of alleviating these hazards, as encountered in employment of x-rays, radioisotopes, neutron fluxes and particle accelerators.

Courses are each two weeks in length. Basic Courses which stress basic radiation physics and survey technics will be presented: October 5–16, 1953; January 11–22, 1954; May 3–14, 1954. The Basic Course or its equivalent is a prerequisite for the Intermediate Course. Laboratory assay of radioelements and x-ray survey technics are emphasized in the Intermediate Course which will be presented: October 19–30, 1953; January 25–February 5, 1954; May 17–28, 1954. Completion of the Intermediate Course or its equivalent is a prerequisite for admission to the Advanced Course. This course, for professional personnel concerned in particular with occupational health problems, will be presented: February 8–19, 1954. Further details and information may be obtained by writing:

Chief, Radiological Health Training Section
Public Health Service
Environmental Health Center
Cincinnati, Ohio.

ACCURATE rates of the heart beat and respiration of the smallest living mammal, the longtail shrew, have been obtained for the first time by three University of Wisconsin zoologists. The zoologists, Drs. Peter R. Morrison, Fred Ryser and Albert R. Dawe, recorded the respiration of the shrew by using the same instrument—a strain gauge—that engineers employ to measure how much a steel beam bends under pressure. The gauge was held against the shrew in such a way that it would record the chest movement that resulted from breathing. They found that the shrew breathes at the rate of some 800 times a minute on the average. Then by using four small electrodes under the shrew's feet, the zoologists obtained electrocardiograms and found that the heart of the shrew raced along at the extremely high rate of from 500 to 1,300 beats a minute, or some 10 to 20 a second. This great speed reflects the general physiology of the shrew, the zoologists explain. In addition to being the smallest mammal it is just about the fastest from a metabolic standpoint, burning up to three times its weight in food a day.

THE new books we list are all of the highest caliber. Should you wish a work on one of the subjects enumerated we believe you will be satisfactorily rewarded by your purchase.

An Atlas of Surgical Exposures of the Extremities, by Sam W. Banks, M.D. and Harold Laufman, M.D., Ph.D., with 552 illustrations on 179 plates and an index. 391 pages. W. B. Saunders Co. $15.

Physical Examination of the Surgical Patient, by J. Englebert Dunphy, M.D., F.A.C.S. and Thomas W. Botsford, M.D., F.A.C.S. Contains 188 figures, a bibliography, appendix and index. 326 pages. W. B. Saunders Company. $7.50.

The Management of Abdominal Operations, edited by Rodney Maingot, F.R.C.S. Deals with the practical aspects of abdominal surgery. Contains 327 figures, an index of names and an index of subjects. 1,253 pages. The Macmillan Company. $24.

Morris' Human Anatomy: A Complete Systematic Treatise, edited by J. Parsons Schaeffer, M.A., M.D., Ph.D., D.Sc., LITT.D., 11th ed. Contains 1,220 figures (many in color), references at chapter endings and an index of 109 pages. 1,718 pages. The Blakiston Company. $16.

(continued on page 50)

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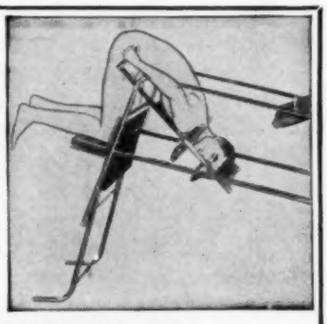

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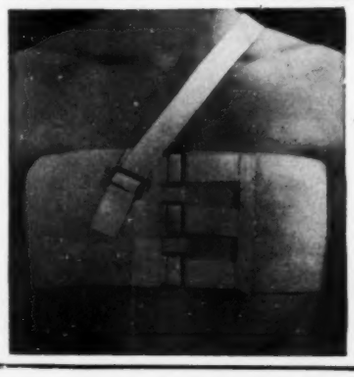

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(*continued from page 48*)

A Short Practice of Surgery, by Hamilton Bailey, F.R.C.S. and R. J. McNeill Love, F.R.C.S., 9th ed. Contains an index and 1,234 illustrations of which 272 are colored. 1,254 pages. The Williams & Wilkins Company. $12.50.

Operative Gynecology, by Richard W. Te Linde, M.D., 2nd ed. Includes viewpoint of surgeon, pre- and postoperative care, and improved anesthesia. Contains 409 figures, seven colored plates and an index. 902 pages. J. B. Lippincott Company. $20.

The Surgery of Pancreatic Neoplasms, by Rodney Smith, M.S., F.R.C.S. Awarded The Jacksonian Prize for 1951 by the Council of the Royal College of Surgeons. Contains an appendix, index and illustrations (some in color). 157 pages. The Williams & Wilkins Company. $7.

Injury of the Xiphoid, by Michael Burman, M.D. and Samuel E. Sinberg, M.D. Contains bibliography, index and illustrations. 92 pages. Columbia University Press.

Conduction Anesthesia, by George P. Pitkin, M.D., F.A.C.S., F.I.C.A., edited by James L. Southworth, M.D., Robert A. Hingson, M.D. and Winifred M. Pitkin, M.D., 2nd ed. Contains a bibliography, index and 585 illustrations (some in color). 1,004 pages. J. B. Lippincott Company. $22.50.

AT least three-quarters of the white girl babies born in the United States this year will survive to their sixty-sixth birthday, as contrasted with a corresponding age of twenty-eight years under the health conditions prevailing in 1900, according to the Metropolitan Life Insurance Company statisticians. The age to which 75 per cent of the male white babies may be expected to survive has advanced from somewhat less than twenty-three years under the health conditions of 1900 to about fifty-nine years under current mortality conditions.

WOMEN have more years of schooling than men in the United States and their educational level is advancing the more rapidly. In 1950 women at ages twenty-five and over had on the average 9.6 years of schooling compared with 9.0 years for men. For women the average years of school completed increased by almost one year in the past decade, while for men the rise was not quite one-half year, according to Bureau of the Census data. Every state in the union shared in the improvement, but the largest gains were made in the West, which widened its lead over other sections of the country. Washington showed the outstanding gain in the country, the average years of school completed among those at ages twenty-five and over increasing by two years since 1940 to an average of 11.2 years in 1950.

THE first test tube creation of one of the vital substances found in the nucleus of living cells has been accomplished by Prof. Gerald A. LePage, cancer researcher at the University of Wisconsin's McArdle Memorial Laboratory for Cancer Research. The substance is known as adenine and is the building block for one of the nucleic acids, which in turn are building blocks for chromosomes, the structures responsible for the transmission of genetic characteristics from parent cell to offspring.

LePage has succeeded in getting test tube production of adenine in two ways. In the first method animal tissue, either normal or cancerous, is homogenized and centrifuged to separate certain enzyme systems. Glycine, one of the amino acids, is converted to adenine by these systems. In the second method ascites cells are used to maufacture adenine. Ascites cells are a kind of free-living cancer cell found in the abdominal cavity with some forms of cancer. The process is followed by means of radioactive tracers in an effort to determine the chemical mechanisms of the adenine production in the living ascites cells.

LePage explained that the study will reveal more of the chemical systems that permit cells to live and work, and eventually the subtle differences that exist in the manner in which cancerous and normal cells accomplish chemical syntheses.

MORE than 500 American and European surgeons attended the recent meeting in Rome of the Italian chapter of the International College of Surgeons. Prof. Dr. Raffaele Paolucci of Rome was elected president of the chapter; he also won a senate seat in the recent Italian elections. The Rome Surgical Society conferred honorary fellowships on Raymond W. McNealy of Chicago, Charles P. Bailey, Philadelphia, and Edgar F. Berman, Baltimore.

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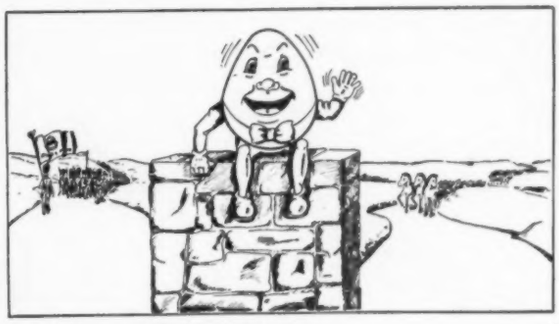

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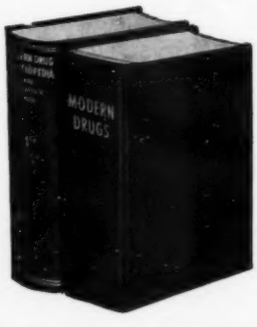

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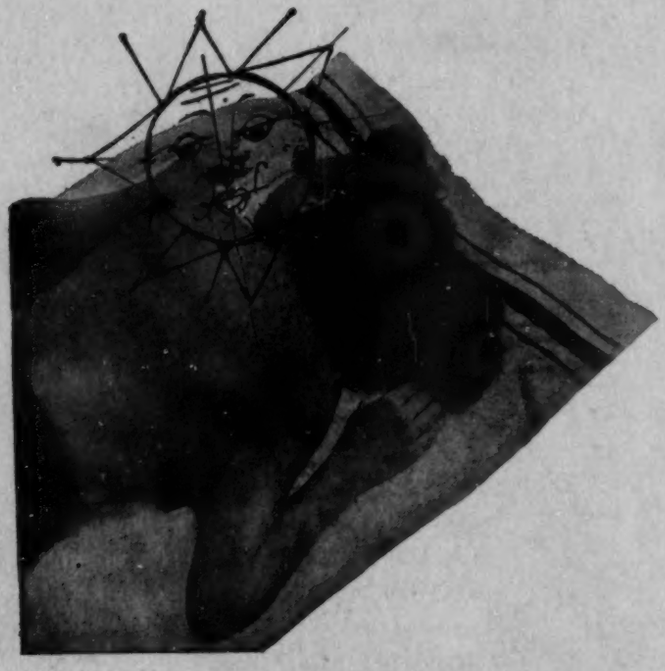

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